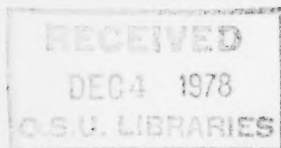


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# SELECTED ≡ WATER RESOURCES ABSTRACTS

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VOLUME 11, NUMBER 16  
AUGUST 15, 1978



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# SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology,  
U.S. Department of the Interior



**VOLUME 11, NUMBER 16**  
AUGUST 15, 1978

W78-07201 -- W78-07700

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department.

ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

**A**s the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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## FOREWORD

**S**electing Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

**Selected Water Resources Abstracts** is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center  
Office of Water Research and Technology  
U.S. Department of the Interior  
Washington, DC 20240

# CONTENTS

|                |     |
|----------------|-----|
| FOREWORD ..... | iii |
|----------------|-----|

## SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

- 01 **NATURE OF WATER**  
Includes the following Groups: Properties; Aqueous Solutions and Suspensions
- 02 **WATER CYCLE**  
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.
- 03 **WATER SUPPLY AUGMENTATION AND CONSERVATION**  
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.
- 04 **WATER QUANTITY MANAGEMENT AND CONTROL**  
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.
- 05 **WATER QUALITY MANAGEMENT AND PROTECTION**  
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.
- 06 **WATER RESOURCES PLANNING**  
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.
- 07 **RESOURCES DATA**  
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.
- 08 **ENGINEERING WORKS**  
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.
- 09 **MANPOWER, GRANTS, AND FACILITIES**  
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.
- 10 **SCIENTIFIC AND TECHNICAL INFORMATION**  
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

## 2. WATER

### 2A. General

TRANSFORMING  
BUDGET OF  
For primary  
W78-07376

WATER  
CHANGE,  
Department  
(England). W  
J. C. Rodda,  
Journal of the  
Scientists, V  
fig. 2 tab. 20

Descriptors:  
\*Rainfall, \*  
River flow,  
Foreign con  
change.

A decline in  
Wales during  
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Iowa Univ.  
H. Rouse,  
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GENERATING  
DATA,  
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engineering.  
G. A. Fuller,  
Journal of  
Society of

# SELECTED WATER RESOURCES ABSTRACTS

## 2. WATER CYCLE

### 2A. General

**TRANSFORMATION OF THE HYDROLOGIC BUDGET OF THE MOSCOW CITY AREA,**  
For primary bibliographic entry see Field 4C.  
W78-07376

#### WATER RESOURCES AND CLIMATIC CHANGE,

Department of the Environment, Reading (England). Water Data Unit.  
J. C. Rodda, A. V. Sheckley, and P. Tan.  
Journal of the Institution of Water Engineers and Scientists, Vol. 32, No. 1, p 76-83, January 1978. 4 fig, 2 tab, 20 ref.

Descriptors: \*Water resources, \*Climatology, \*Rainfall, \*Forecasting, Annual, Flow duration, River flow, Winter, Summer, Data collections, Foreign countries, \*England, \*Wales, Climatic change.

A decline in winter rainfalls over England and Wales during the last 50 years and a ten-year periodicity are established, while forecasts of winter rainfalls are made for ten years ahead. The flows in the rivers Thames and Severn show the opposite to what might be expected from these rainfalls. Forecasts of climate and climatic change are only some of the factors that water resource planners have to take into account. Forecasting the future demand for water and ensuring an efficient distribution system require far more attention. After all, the present demand for water represents about 36 mm a year out of an average total runoff from England and Wales of about 428 mm a year, not all of which is available for use; so that even in demand doubles soon after the turn of the century, the main problem concerning water will be the distribution of this resource rather than a basic lack of it. (Humphreys-ISWS)  
W78-07380

#### FIRST FOUR DECADES OF THE HYDRAULICS DIVISION,

Iowa Univ., Iowa City.  
H. Rouse.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY3, Proceedings Paper 13633, p 327-336, March 1978. 8 fig.

Descriptors: \*History, \*Hydraulics, \*Conferences, Water, Water level recorders, Water management (Applied), Water circulation, Water utilization, Water resources, \*ASCE (Conferences), \*ASCE (Technical Divisions), \*Iowa Hydraulics Conference.

This was an account of the background of the American Society of Civil Engineers Hydraulics Division and its establishment in 1939, as well as the roles played by F.C. Scobey, B.A. Bakhmeteff, G.H. Matthes, C.H. Paul, and J.C. Stevens in its early years. Attention also was focused on the series of Iowa Hydraulics Conference begun by F.T. Mavis in 1939 and their gradual evolution into the Division's Specialty Conferences initiated by A.S. Fry in 1950. The lists of past Division Chairmen and that of Specialty Conference hosts were given in full. (Roberts-ISWS)  
W78-07382

#### GENERATION OF UNGAGED STREAMFLOW DATA,

Saskatchewan Univ., Regina. Dept. of Civil Engineering.  
G.A. Fuller.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY3,

Proceedings Paper 13590, p 377-384, March 1978. 2 fig, 2 tab, 9 ref, 2 append.

Descriptors: \*Hydrologic data, \*Streamflow, \*Synthetic hydrology, \*Regression analysis, \*Canada, Runoff, Hydrology, Methodology, Statistical methods, Model studies, Least squares method, \*Ungaged watersheds, Rosenbrock's method, Predictor variables.

A least squares model for estimating monthly and daily mean streamflow data at ungaged sites was developed. The predictor variables are streamflow data recorded at nearby hydrometric sites. The parameters required by the model are estimates of the mean and standard deviation of flow at the ungaged site and estimates of the correlation coefficients between flows at the ungaged site and nearby hydrometric sites. These parameters were obtained from least squares models using physiographic characteristics as predictor variables. Computational problems were experienced when the estimated correlation matrix was not positive semidefinite. These problems were overcome by adjusting the estimated correlation coefficients using Rosenbrock's hill climbing method to make the matrix positive semidefinite. The model was tested by estimating streamflow records in central Canada. The records were assumed to be nonexistent. The reliability of the estimated data depended primarily upon the accuracy with which the model parameters were determined. (Singh-ISWS)  
W78-07384

#### S-HYDROGRAPHS AND CHANGE OF UNIT HYDROGRAPH DURATION,

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.  
G. W. Tauxe.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY3, Technical Note, p 439-444, March 1978. 1 fig, 3 tab, 7 ref.

Descriptors: \*Hydrograph analysis, \*Unit hydrograph, \*Watershed (Basins), \*Runoff, Hydrographs, Duration curves, Mathematical models, Analytical techniques, Analysis, Discharge (Water), S-hydrographs, \*Hydrograph duration.

The S-hydrograph or S-curve is the hydrograph corresponding to a uniform rainfall of infinite duration. It is used as an intermediate hydrograph in unit hydrograph theory to derive from a specified unit hydrograph of a given duration or other unit hydrographs of different durations. One common problem in this unit hydrograph derivation is the fluctuations of both the S-hydrograph and the later portion of derived unit hydrographs. A new approach, the Forward-Backward-S-curve, which minimizes this fluctuation problem, was described. In addition computing the S-curve in the traditional forward manner, compute another S-curve, but, in a backward manner. This Backward S-curve is computed in a manner which is similar to the forward S-curve except that this S-curve begins from the equilibrium discharge value and is computed backward in time instead of forward from time zero. The Forward-Backward-S-curve demonstrated that by relocating the effects of the original assumptions, the resulting unit hydrograph preserves the runoff volume and the base time in generated unit hydrographs without arbitrary smoothing of the S-curve. An additional advantage of the F-B-S-curve lies in computer applications, where the results may be obtained directly. (Humphreys-ISWS)  
W78-07385

**INVESTIGATION OF LEVEL FLUCTUATIONS IN CLOSED BODIES OF WATER ON THE BASIS OF STOCHASTIC MODELS OF THE ELEMENTS OF THE HYDROLOGIC BUDGET,**  
For primary bibliographic entry see Field 2E.

W78-07500

**DERIVATION OF INITIAL SOIL MOISTURE ACCOUNTING PARAMETERS FROM SOIL PROPERTIES FOR THE NATIONAL WEATHER SERVICE RIVER FORECAST SYSTEM,**  
National Weather Service, Silver Spring, MD. Office of Hydrology.  
For primary bibliographic entry see Field 2G.  
W78-07551

#### URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH: INTERNATIONAL SUMMARY,

American Society of Civil Engineers, New York.  
M. B. McPherson, and F. C. Zuidema.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 754, Price codes: A03 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-13, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, New York, N.Y., November 1977. 51 p, 9 fig, 2 tab, 39 ref. NSF INT77-15021, ENG74-20326.

Descriptors: \*Model studies, \*Urban hydrology, \*Reviews, \*Europe, \*Research and development, Urbanization, Watersheds (Basins), Hydrologic aspects, Documentation, Institutions, Water resources, Water balance, Systems analysis, Foreign research, Foreign countries, Urban runoff, Water quality, Urban drainage, Planning, Design, Management, Urban watersheds.

Twelve national reports for the International Hydrological Programme (IHP) were compiled on the state-of-the-art in urban catchment research and hydrological modeling, with particular attention given to underground conduit systems. Summarized in this report were the countries, principal commonalities, together with particularly noteworthy observations or advances reported for individual countries. The twelve national reports are for: the USA, Australia, Canada, the United Kingdom, the USSR, the Federal Republic of Germany, Sweden, France, Norway, the Netherlands, Poland, and India. Most of the substantial progress that has been made has taken place in the 1970's. However, to be consistent with the economic and social importance of urban drainage, much more needs to be done everywhere. Three fundamental research objectives were identified with regard to urban runoff: determination of the hydrological effects of urbanization; development of measures that would offset the adverse effects and enhance the assets of urban runoff; and resolution of improved tools of analysis for the planning, design, and operation of urban drainage systems. However, insufficient knowledge has been acquired on crucial characteristics, such as on the processes involved in the accumulation, distribution and transport of pollutants. This summary report was addressed principally to practitioners in urban hydrology. (See W78-07690 thru W78-07700 and W77-02754) (Humphreys-ISWS)  
W78-07689

#### URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN INDIA,

Indian Inst. of Tech., Kanpur; and Indian Agricultural Research Inst., New Delhi.  
S. Ramaseshan, and P. B. S. Sarma.  
Technical Memorandum No. IHP-12, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, May 1977. 21 p, 3 fig, 3 tab, 19 ref. NSF-ENG/74-20326.

Descriptors: \*Urbanization, \*Hydrologic aspects, \*Data collections, \*Computer models, \*India, \*International Hydrological Programme, Urban runoff, Urban drainage, Design criteria, Rainfall-runoff relationships, Hydrologic data, \*Urban hydrology, Urban rainfall-runoff-water quality



## Field 2—WATER CYCLE

### Group 2A—General

relationships. Simulation, Urban runoff gaging. Combined sewer overflows. Storm sewer discharges.

Prepared in support of International Hydrological Programme Project 7, 'Effects of Urbanization on the Hydrological Regime and on Water Quality,' this is the twelfth of a special ASCE Urban Water Resources Research Program technical memorandum series of national state-of-the-art reports. These reports are principally addressed to users of research findings. Design criteria for underground conduit drainage systems in India is emphasized, with a review of associated modeling and catchment research activities. (See also W78-07689) (ASCE) W78-07690

#### URBAN RUNOFF RESEARCH IN POLAND, Research Inst. on Environmental Development, Warsaw (Poland). P. Błaszczyk.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 871. Price codes: A02 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-11, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, New York, N.Y., Feb 1977. 11 p, 1 fig, 14 ref.

Descriptors: \*Urban runoff, \*Research and development, \*Hydrology, \*Urban hydrology, \*Watersheds(Basins), \*Sewers, \*Storm drains, \*Combined sewers, \*Runoff, \*Rainfall, \*Water pollution, \*Water quality, \*Measurements, \*Foreign research, \*Poland, \*Urban watersheds.

Since 1972, the Research Program of Urban Sewerage and Drainage Schemes has been conducted by the Research Institute on Environmental Development in cooperation with the Institute for Water Supply and Water Constructions at the Technical University in Warsaw. The main objective of the Program is the verification of assumptions and methods for planning and designing stormwater and combined sewer schemes in large urban areas. Specific objectives of the Program include definition of: (1) the relations between rainfall and the runoff from urban combined sewer and stormwater schemes, as well as the pollution content of precipitation and runoff; (2) the influence of the storage capacity of drainage networks and flow-balancing tanks on the diminution of pollution loads transported by stormwater to receiving waters; and (3) the influence of short and undetermined rainfalls on the quality of receiving waters. A report presenting all research accomplishments for the years 1972-1976 within the Research Program of Urban Sewerage and Drainage Schemes was expected to be issued at the end of 1976. (See also W78-07689) (Humphreys-ISWS) W78-07691

#### URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN THE NETHERLANDS, Rijksdienst voor de IJsselmeerpolders, Lelystad (Netherlands). F. C. Zuidema.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 587. Price codes: A04 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-10, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, New York, N.Y., January 1977. 49 p, 19 fig, 2 tab, 36 ref.

Descriptors: \*Urban hydrology, \*Model studies, \*Reviews, \*Urban runoff, \*Rainfall, \*Discharge(Water), \*Measurement, \*Instrumentation, \*Hydrographs, \*Data processing, \*Groundwater, \*Mathematical models, \*Foreign research, \*Water quality, \*Water management(Applied), \*Netherlands, \*Urban watersheds, \*Polders.

Current (1977) research on urban catchments was described. Attention was given to instrumentation, data processing, and data analysis. Urban hydrological models developed and used in The Netherlands can be divided into three broad categories: (1) planning models, used in macro-scale applications, such as for metropolitan or city-wide master plans; (2) design-analysis models, hydraulically more sophisticated and thus more detached tools; and (3) operation models, likely to be more application-specific than planning or design models. Briefly described were eight studies on mathematical modeling and their applications. Included was a description of a water resources management system that can be considered as a comprehensive urban water model. (See also W78-07689) (Humphreys-ISWS) W78-07692

#### URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN NORWAY, Norges Vassdrags- og Elektrisitetsvesen, Oslo. Hydrological Div. N. R. Selthun.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 365. Price codes: A03 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-9, ASCE Urban Water Resources Research Program American Society of Civil Engineers, New York, N.Y., December 1976. 23 p, 2 fig, 3 tab, 21 ref.

Descriptors: \*Urban hydrology, \*Model studies, \*Reviews, \*Watersheds(Basins), \*Urban runoff, \*Measurement, \*Rainfall, \*Urbanization, \*Sewers, \*Combined sewers, \*Storm drains, \*Water quality, \*Waste water treatment, \*Mathematical models, \*Foreign research, \*Norway, \*Urban watersheds.

Until the last few years, hydrological research on urban catchments has been virtually non-existent in Norway. The design of urban drainage systems has relied on practices developed abroad. The first systematic urban catchment investigations are being carried out as part of two projects in the Norwegian research program for purification of wastewater: Project 4.2, the effect of urbanization on runoff from small catchments; and Project 4.7, investigations on urban runoff composition. A briefly described model package developed at the Norwegian Institute for Water Research consists of two models: a network model handling combined sewer and separate storm sewer systems and a wastewater treatment plant model. (See also W78-07689) (Humphreys-ISWS) W78-07693

#### URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN FRANCE, Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathématique.

M. Desbordes, and D. Normand. Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 524. Price codes: A04 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-8, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, New York, N.Y., November 1976. 65 p, 1 tab, 53 ref, 3 appendix.

Descriptors: \*Urban hydrology, \*Model studies, \*Demonstration watersheds, \*Reviews, \*Watersheds(Basins), \*Urban runoff, \*Measurement, \*Instrumentation, \*Rainfall, \*Runoff, \*Water quality, \*Mathematical models, \*Discharge(Water), \*Foreign research, \*France, \*Urban watersheds.

The present (1976) status of urban hydrology research in France and plans for future research were reviewed. The following were briefly described: nine experimental watersheds, program data treatment, studies of instruments for hydrological measurement, rainfall, runoff, and water quality. The necessity of acquiring reliable data very quickly was shown. Hydrologic models developed were described. Three appendixes

described in more detail a general study of urban runoff drainage, a mathematical model of flood and pollutant propagation in a meshed drainage network, and an extension of Caquot's model to non-homogeneous catchments. (See also W78-07689) (Humphreys-ISWS) W78-07694

#### URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN SWEDEN, Lund Inst. of Tech. (Sweden); and Dept. of Water Resources Engineering. G. Lindh.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 523. Price codes: A03 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-7, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, New York, N.Y., October 1976. 15 fig, 29 ref.

Descriptors: \*Urban hydrology, \*Model studies, \*Hydrologic budget, \*Urban runoff, \*Measurement, \*Discharge(Water), \*Watersheds(Basins), \*Rainfall, \*Water sampling, \*Water quality, \*Hydrographs, \*Mathematical models, \*Data transmission, \*Foreign research, \*Urbanization, \*Sweden, \*Urban watersheds.

Results of a review of research needs in urban hydrology summarized Sweden's water budget in areas, pollution load due to urbanization, and community costs for water management in urban areas. Urban catchment research described for two of seven experimental basins included measurement of rainfall and runoff, central recording of data, water quality sampling, runoff from sub areas, data transmission systems, and hydrographs for two short, intensive storms. Hydrologic models developed were described. In general, the applied method of analysis was divided into the three parts: (1) runoff from previous or impervious surfaces was calculated with due regard to the hydrological water balance equation; (2) the runoff process was regarded as starting when storm runoff enters gutter inlets; and (3) it was concluded that the runoff process may be considered as the treatment of polluted stormwater before discharging it to a receiving water body. There is a need for more experimental data to test the usefulness of theoretical models. (See also W78-07689) (Humphreys-ISWS) W78-07695

#### URBAN HYDROLOGY STUDIES AND MATHEMATICAL MODELING IN THE FEDERAL REPUBLIC OF GERMANY, Landesanstalt fuer Wasser und Abfall Nordrhein-Westfalen, Dusseldorf (West Germany). H. Massing.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 364. Price codes: A04 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-6, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, New York, N.Y., September 1976. 56 p, 5 fig, 4 tab, 223 ref.

Descriptors: \*Urban hydrology, \*Model studies, \*Reviews, \*Storm runoff, \*Urban runoff, \*Sewers, \*Discharge(Water), \*Groundwater recharge, \*Watersheds(Basins), \*Infiltration, \*Artificial recharge, \*Hydrologic cycle, \*Mathematical models, \*Foreign research, \*Water quality, \*Surface runoff, \*Urbanization, \*Precipitation(Atmospheric), \*Excess precipitation, \*Federal Republic of Germany, \*Urban watersheds.

Urban hydrology is that part of the comprehensive field of hydrology which deals with effects and phenomena in human settlements. Urban catchment research and studies were described to provide an insight into the hydrology of urban catchments. Covered in the report were: measuring and research instruments, investigation methods, assessment techniques, and research

results. Subj. measurement runoff from changes due to water rege receiving str solid waste calculation stormwater marized the ysis and sin sewer system related mod development models were hydraulic fe miscellane (Humphreys W78-07696

#### METHODS FLOOD WATERCO. U.S.S.R., Gosudarstv grad (USSR) V. V. Kupri Available f tion Service

Price codes Technical M Water Res Society of gust 1976. 2

Descriptors \*Floods, \* nuff, Ana Precipitation flow, Roughness nuff, Flood time, Precip

The author used in the application coefficient flood hydro were tabul roughness coefficient discharge. ISWS) W78-07697

#### URBAN F KINGDOM. Institute of M. J. Lowi Available f tion Service

Price codes Technical M Water Res Society of 1976. 28 p.

Descriptor \*Reviews, \*Watershed quality, M research, processing, mentation,

Urban hy catchments lot drainin the domin mainly nat portion of catchment natural wa years, but

## WATER CYCLE—Field 2

### Precipitation—Group 2B

results. Subjects reviewed included precipitation measurement technology, surface runoff, surface runoff from rainfall excess, surface runoff changes due to increased urbanization, ground-water regeneration and recharge, water quality of receiving streams, urban groundwater pollution, solid wastes influence on water quality, and new calculation methods for sewers, rain outlets, and stormwater basins. A section on models summarized the features of various precipitation analysis and simulation models, surface runoff and sewer system models, receiving stream models, related models, and on presently foreseeable developments in modeling. Tabulated for eleven models were comparisons of hydrologic features, hydraulic features, water quality features, and miscellaneous features. (See also W78-07689) (Humphreys-ISWS) W78-07696

#### METHODS FOR CALCULATING MAXIMUM FLOOD DISCHARGES FOR NATURAL WATERCOURSES AND URBAN AREAS IN THE U.S.S.R.,

Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).  
V.V. Kuprianov.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 070, Price codes: A02 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-5, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, New York, N.Y., August 1976. 20 p., 1 fig, 6 tab, 8 ref.

Descriptors: \*Hydrology, \*Watershed(Basins), \*Floods, \*Urban hydrology, Runoff, Surface runoff, Analytical techniques, Peak discharge, Precipitation(Atmospheric), Equations, River flow, Runoff coefficient, Surfaces, Roughness(Hydraulic), Hydrographs, Urban runoff, Flood discharge, Foreign research, Travel time, Precipitation intensity, \*USSR.

The author discussed procedures and relationships used in the USSR for computation of peak flow, application of precipitation data, use of runoff coefficients, flood travel time, flood volumes and flood hydrographs, and flood frequency. Data were tabulated for runoff coefficients, channel roughness coefficients, basin slopes roughness coefficients, precipitation data, and floodwater discharge. (See also W78-07689) (Humphreys-ISWS) W78-07697

#### URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN THE UNITED KINGDOM,

Institute of Hydrology, Wallingford (England).  
M.J. Lowing.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 069, Price codes: A03 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-4, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, New York, N.Y., July 1976. 28 p., 1 fig, 1 tab, 71 ref.

Descriptors: \*Hydrology, \*Model studies, \*Reviews, Urban runoff, Storm runoff, Rainfall, Watersheds(Basins), Planning, Sewers, Water quality, Mathematical models, Flow, Foreign research, Urbanization, Data collections, Data processing, Gaging, Flow measurement, Instrumentation, \*United Kingdom, Urban watersheds.

Urban hydrology covers a wide range of catchments: the small, totally impervious parking lot draining to inlets; medium sized areas where the dominant process is pipe flow; and larger, mainly natural catchments, with a significant proportion of urban development. The latter case, of a catchment being urbanized but still drained by a natural watercourse, has been studied for several years, but again the pace of research is accelerating

as more data are gathered and more workers turn to the topic. Urban catchment research described included: (1) Studies to provide data on rainfall and runoff from urban areas with flow monitored at some convenient point in or at the outfall from a sewer system. (2) Flow monitoring at the entry to the sewer system with the specific aim of calibrating an above-ground model of runoff. (3) Water quality studies. (4) Studies of the effect on flow in natural watercourses as a catchment is urbanized. Urban hydrological models developed in the United Kingdom were described. These models are geared primarily to the improvement of sewer design methods. (See also W78-07689) (Humphreys-ISWS) W78-07698

#### URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN AUSTRALIA,

Snowy Mountains Engineering Corp., Cooma (Australia).  
A.P. Aitken.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 686, Price codes: A03 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-2, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, New York, N.Y., May 1976. 26 p., 3 fig, 4 tab, 14 ref.

Descriptors: \*Hydrology, \*Model studies, \*Reviews, Urban runoff, Storm runoff, Rainfall, Watersheds(Basins), Planning, Water quality, Mathematical models, Foreign research, Floods, \*Urban watersheds, \*Australia.

Results of a critical survey of urban test catchment research and urban hydrological modeling in Australia were presented. The beginning of rainfall-runoff gauging programs began in the mid-1950's when six urban catchments were gauged. A general summary of 69 gauged urban catchments was tabulated. These installations have been established to develop a better understanding in urban areas of the rainfall-runoff process and of rainfall-runoff-water quality relationships. The section on hydrological models briefly reviewed the application to Australian conditions of several mathematical models developed overseas. It was concluded that urban mathematical modeling and urban catchment research in Australia have reached an encouraging level of effort. Also, it was recommended that a careful watch must be maintained to ensure that the quality of data being collected is adequate for future analysis purposes. (See also W78-07689) (Humphreys-ISWS) W78-07699

#### URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN THE U.S.A.,

American Society of Civil Engineers, New York.  
M.B. McPherson.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 685, Price codes: A04 in paper copy, A01 in microfiche. Technical Memorandum No. IHP-1, ASCE Urban Water Resources Research Program, American Society of Civil Engineers, November 1975. 51 p., 13 fig, 2 tab, 169 ref.

Descriptors: \*Hydrology, \*United States, \*Model studies, \*Reviews, Urban runoff, Storm runoff, Watersheds(Basins), Planning, Water quality, Urban drainage, Mathematical models, Sewers, Computer programs, Programs, Urban hydrology, Urban watersheds.

Information was presented on urban hydrological models that have been tested against actual field data. Tabulated data for 16 models identified and described the catchments that were the source of field data used in model testing. Availability and source of computer programs for the mathematical models were given. Urban catchment research requires more attention to quality and quantity aspects of urban runoff to improve the reliability

of hydrologic modeling. A recommended plan for a national program of urban storm drainage research was described briefly. (See also W78-07689) (Humphreys-ISWS) W78-07700

## 2B. Precipitation

#### DALLAS URBAN RUNOFF, STORM OF FEBRUARY 11, 1977.

Dallas Water Utilities Dept., TX. Operations Analysis Div.  
November 30, 1977. 84 p., 43 fig, 10 tab, 12 ref, 4 append.

Descriptors: \*Water pollution sources, \*Urban runoff, \*Storm runoff, \*On-site investigations, \*Texas, Sampling, Data collections, On-site data collections, Water quality, Analysis, Biochemical oxygen demand, Dissolved oxygen, Rainfall, Discharge(Water), Hydrographs, Coliforms, Metals, Heavy metals, Lead, Zinc, Mercury, Nickel, Strontium, Nutrient, Nitrogen compounds, Phosphorus compounds, \*Dallas(TX), Nonpoint pollution sources, Total suspended solids.

The sampling activity for the storm of February 11, 1977, was the third in a continuing program to characterize and quantify the impact of runoff from urbanized areas within the City of Dallas. Runoff from an urban area of about 724 sq mi, mostly within the City of Dallas, was sampled at 17 sites. When the BOD5 and TSS load in the Trinity River at Dallas is totaled for the two day period February 11-12, 1977, and the contribution of the West and Elm Forks is removed, then the 12 hour storm event is found to contribute 75% of the BOD5 load, and 99% of the TSS load. Point sources contributed 25% of the BOD5 load and 1% of the total suspended solids load within the City of Dallas. If Dallas' sewage treatment plants had been producing a 10 mg/l BOD5 load equal to that from 17 days, and a total suspended solids load equal to 361 days, of treatment plant operation (1976 daily average sewage flows). Additional impacts of nonpoint source pollution are dissolved oxygen depletion in localized reaches of the river, transport of large amounts of nutrients to downstream water bodies, high coliform levels, and the addition of metals and pesticides to receiving water bodies. The effects of 'nonpoint' sources of pollution are so great as to overshadow the point sources during storm periods and for weeks thereafter. (Humphreys-ISWS) W78-07361

#### ANALYSIS OF INTENSE PRECIPITATION IN THE KRASNOYARSK AREA,

Ye. L. Zaliznyak.  
Soviet Hydrology: Selected Papers, Vol. 15, No. 3, p 212-214, 1976. 2 fig, 2 tab, 5 ref. Translated from Trudy Gidromettsentra SSSR, No. 190, p 14-18, 1976.

Descriptors: \*Rainfall, \*Weather forecasting, \*Mountains, \*Excessive precipitation, Precipitation(Atmospheric), Cloud physics, Atmosphere, Weather, Atmospheric physics, Equations, Forecasting, Analytical techniques, Rainfall intensity, Meteorology, \*Krasnoyarsk area(USSR), \*USSR.

Results were reported for computations of three heavy rainfalls in the Krasnoyarsk area. The computations were related to meteorologic parameters measured up to 36 hours before the rain. Considering the structural characteristics of the surface pressure field produced by the complex orography of the region, ordered vertical velocities at the 850-mb level were computed. The air-parcel trajectories were constructed from wind data with allowance for the movement of pressure formations. These studies showed that the forecast range of shower precipitation can be increased to 36 hours.

## Field 2—WATER CYCLE

### Group 2B—Precipitation

The accuracy of such forecasts will depend significantly on the quality of the forecast of the surface pressure and geopotential fields. It will be affected less by the shortcomings of the method of determining the convection parameters. This method allows for physical factors, the reality of which is supported by diagnostic data and forecasts of showers of varying intensity 12 hours in advance. (Sims-ISWS)  
W78-07374

#### WATER RESOURCES AND CLIMATIC CHANGE

Department of the Environment, Reading (England). Water Data Unit.  
For primary bibliographic entry see Field 2A.  
W78-07380

#### VARIABILITY OF HAILSTORMS ON THE SOUTH AFRICAN PLATEAU

Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.  
A. E. Carte, and G. Held.  
Journal of Applied Meteorology, Vol. 17, No. 3, p 365-373, March 1978. 12 fig, 30 ref.

Descriptors: \*Hail, \*Storms, \*Variability, On-site investigations, Data collections, Meteorological data, Precipitation (Atmospheric), Seasonal, Radar, Distribution patterns, Frequency analysis, Weather, Meteorology, \*South Africa, Hailstones, Hailstorms.

Detailed climatological studies of hailstorms on the South African plateau have been made using a dense network of voluntary observers. Hailstone structures have been investigated and, since 1971, radar observations have been used to study storm characteristics. Results were given for the frequency of hailstorm occurrence, characteristics, of hailfalls at a point, hail paths, types of storms, radar characteristics, and hailstone trajectories. Practically all features showed great variability, the magnitude of which is given whenever possible. Application of the results to the design of a hail suppression experiment was discussed briefly. (Sims-ISWS)  
W78-07507

### 2C. Snow, Ice, and Frost

#### VISUAL OBSERVATIONS OF FLOATING ICE FROM SKYLAB

Geological Survey, Tacoma, WA. Water Resources Div.; Department of the Environment, Ottawa (Ontario); and Cold Regions Research and Engineering Lab., Hanover, NH.  
W. J. Campbell, R. O. Ramseier, W. F. Weeks, and J. A. Wayenberg.  
SkyLab Explores the Earth, p 353-379, 1977. 26 fig, 2 ref.

Descriptors: \*Remote sensing, \*Ice, \*Movement, \*North America, \*Aerial photography, Satellites (Artificial), Aircraft, Rivers, Lake Ontario, Bays, Oceans, Canada, Sea ice, Navigation, Ships, Data collections, \*SkyLab, \*Floating ice, Gulf of Saint Lawrence, Saint Lawrence River, Hudson Bay, Sea of Okhotsk, Ground measurements.

The lake and sea ice visual observation experiment performed during the Skylab 4 mission was very successful. In the initial experiment design, the Gulf of St. Lawrence and Lake Ontario were chosen as prime sites at which ground-truth measurements and aircraft remote-sensing data were to be obtained. In addition, the Skylab 4 astronauts obtained excellent photographs of sea ice in the Sea of Okhotsk and in the James Bay portion of Hudson Bay and of icebergs in the Southern Ocean. Some of the sequential photographs contain very useful broad-scale information on the

distribution of ice and ice types, the overall deformation patterns, and the amount of relative ice motion. Information obtained from this experiment will be invaluable for interpreting the Skylab Earth resources experiment package data, the aircraft remote-sensing data acquired from four aircraft which participated in the experiment, the ground measurements acquired from a ship in the Gulf of St. Lawrence, and the data obtained from a helicopter and from hovercraft in Lake Ontario. (Woodard-USGS)  
W78-07346

#### DIELECTRIC CONSTANT AND ELECTROCONDUCTANCE OF SOME DRY FROST-PRONE SOILS

Rutgers - The State Univ., New Brunswick, NJ. Dept. of Civil and Environmental Engineering.  
A. R. Jumikis.  
Soil Science, Vol. 125, No. 3, p 170-177, 1978. 6 fig, 1 tab, 17 ref. NSF GK-1294.

Descriptors: \*Electrical conductance, \*Soils, \*Frost, \*New Jersey, Soil physical properties, Porosity, Soil mechanics, Soil density, Permafrost, Instrumentation, Dielectric constant, Frost-prone soils.

Dissipation factors of eight dry, frost-prone, New Jersey soils were measured at a frequency 1 kc/s at various soil porosities for a temperature range from -40C to +40C, and relative dielectric constants of the same soils were determined. Also, by electrical measurements, the electroconductance of the same soils was determined. The relative dielectric constants thus found vary from  $D = 1.970$  to  $D = 4.650$ . The corresponding conductances of these dry soils vary from 0.199 nano mhos to 2.677 nano mhos. This work strengthens thermal soil mechanics as an engineering discipline and serves as a basis for similar studies of dry and moist, frozen and unfrozen soils for calibration and comparison, thus adding to the store of man's knowledge. The dielectric constant of dry and moist, frozen and unfrozen soils, also is receiving increasing attention from those interested in permafrost and in man's various engineering activities in the Arctic, Antarctic, and on the moon. (Visocky-ISWS)  
W78-07369

#### NORTH AMERICAN GLACIAL HISTORY EXTENDED TO 75,000 YEARS AGO

Washington Univ., Seattle. Dept. of Zoology; and Washington Univ., Seattle. Dept. of Geological Sciences.  
M. Stuiver, C. J. Heusser, and I. C. Yang.  
Science, Vol. 200, No. 4337, p 16-21, April 7, 1978. 3 fig, 21 ref.

Descriptors: \*Glaciology, \*Dating, \*Radioactive dating, \*Great Lakes Region, \*Pacific Northwest U.S., Geologic time, Radioactivity techniques, Carbon radioisotopes, \*History, Analytical techniques, Methodology, Laboratory tests, Radiocarbon dating, Chronology, Glacial history, Laurentide ice sheet.

By concentrating carbon-14 through thermal diffusion, it is possible to extend the range of carbon-14 dating to 75,000 years ago. Samples with very low contamination levels have been encountered, and a reliable chronology appears possible. A Pacific Northwest climatic curve has been derived from palynological studies. The Pacific Northwest curve and the Great Lakes glacial history were age-calibrated by radiocarbon dating. The climatic patterns in the Pacific Northwest and Northwest Europe were similar in the early part of the last glaciation, with interstadial near 60,000 65,000 and 70,000 years ago. An age of 74,700 years for the St. Pierre Interstadial indicates a possible correlation with the previous interglacial. (Humphreys-ISWS)  
W78-07372

#### INVESTIGATION OF SNOW CONTROL SYSTEMS ON AN AVALANCHE SLOPE

For primary bibliographic entry see Field 4A.  
W78-07375

### 2D. Evaporation and Transpiration

#### THE DISHONEST METHOD IN STREAM TEMPERATURE MODELING

Bonneville Power Administration, Portland, OR.  
W. L. Morse.  
Water Resources Research, Vol. 14, No. 1, p 45-51, February 1978. 1 tab, 18 ref.

Descriptors: \*Water temperature, \*Streams, \*Model studies, \*Mathematical models, Stochastic processes, Mathematics, Statistics, Statistical models, Temperature, Streamflow, Solar radiation, Evaporation, Heat, Heat transfer, Hydrology.

The unidimensional form of the thermal energy conservation principle as a quasi-linear partial differential equation (PDE) has been shown accurate for point temperature forecasts on completely mixed streams and river-run reservoir systems. Two methods of solution were presented which lead to a unique solution. Yet this nonrandom solution was contrary to the behavior of nature, and so a philosophical change was introduced. From the PDE subsidiary differential system a stochastic differential equation (SDE) was obtained with random forcing function from the meteorologic and forebay-depth analyses. With random initial conditions (time-averaged components of the in situ water temperature vector), the SDE was recasted as a random nonlinear Volterra integral equation (RIE). Then a solution to the random-initial-conditions RIE (fixed points of the expectations) by the so-called dishonest method was compared with a solution obtained by repetitively solving the PDE as a random equation (expectations of the fixed points). Of course, these solutions, obtained by 'dishonest and honest' methods, are not necessarily unique, but they may be sufficiently close in some sense. Hence, proper interpretation and use of this RIE model would enable water resource planners to determine economically stream temperatures in probability during critical climatic or river flow conditions. And then intelligent planning and scheduling could avoid some catastrophic aquatic event which might occur as a result of extreme water temperatures. (Sims-ISWS)  
W78-07392

#### HYDROLOGICAL STUDIES ON A SMALL BASIN ON THE CANADIAN SHIELD

Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.  
For primary bibliographic entry see Field 2H.  
W78-07406

### 2E. Streamflow and Runoff

#### FLOOD DAMAGES ON THE IOWA RIVER

Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
For primary bibliographic entry see Field 4A.  
W78-07258

#### DOWNSTREAM-UPSTREAM RESERVOIR ROUTING

Geological Survey, Bay Saint Louis, MS. Water Resources Div.  
For primary bibliographic entry see Field 4A.  
W78-07344

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## Streamflow and Runoff—Group 2E

**SAS RIVER BASIN COMPACT, ARKANSAS--OKLAHOMA, 1977 WATER YEAR,**  
Geological Survey, Little Rock, AR. Water Resources Div.  
For primary bibliographic entry see Field 4A.  
W78-07345

**RAINFALL AND RUNOFF DATA FROM SMALL BASINS IN WYOMING,**  
Geological Survey, Cheyenne, WY. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-07349

**TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN ILLINOIS,**  
Geological Survey, Champaign, IL. Water Resources Div.  
For primary bibliographic entry see Field 4A.  
W78-07350

**FREQUENCY ANALYSIS OF ILLINOIS FLOODS USING OBSERVED AND SYNTHETIC STREAMFLOW RECORDS,**  
Geological Survey, Champaign, IL. Water Resources Div.  
For primary bibliographic entry see Field 4A.  
W78-07355

**FLOOD-HAZARD STUDY--100-YEAR FLOOD STAGE FOR LUCERNE LAKE, SAN BERNARDINO COUNTY, CALIFORNIA,**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 4A.  
W78-07359

**FLOODING IN BIG THOMPSON RIVER, COLORADO, TRIBUTARIES: CONTROLS ON CHANNEL EROSION AND ESTIMATES OF RECURRENCE INTERVAL,**  
Colorado Univ., Boulder. Dept. of Geography; and Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.  
For primary bibliographic entry see Field 4D.  
W78-07371

**GENERATION OF ENGAGED STREAMFLOW DATA,**  
Saskatchewan Univ., Regina. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2A.  
W78-07384

**S-HYDROGRAPHS AND CHANGE OF UNIT HYDROGRAPH DURATION,**  
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2A.  
W78-07385

**NONSTATIONARITY OF THE MEAN AND THE HURST PHENOMENON,**  
Colorado State Univ., Fort Collins. Dept. of Statistics.  
D. C. Boes, and J. D. Salas.  
Water Resources Research, Vol. 14, No. 1, p 135-143, February 1978. 11 fig, 5 tab, 12 ref. NSF ENG-17396.

Descriptors: \*Model studies, \*Mathematical models, \*Streamflow, Statistics, Statistical models, Stochastic processes, Mathematics, Equations, Simulation analysis, Synthesis, Hydrology, Synthetic hydrology, \*Hurst phenomenon.

Hurst, Klemes, and Potter showed that nonstationarity of the mean provides a possible explanation of the so-called Hurst phenomenon.

O'Connell and Wallis and O'Connell showed that this phenomenon also can be explained with a mixed autoregressive-moving average (ARMA) process. These two alternate explanations can be quite similar; in fact, both Hurst's model and a model suggested by Klemes and Potter have correlation structure identical to an ARMA (1, 1) process. A mixture model for shifting level was proposed, and it was shown that the models of Hurst and Klemes and Potter are special cases. (Sims-ISWS)  
W78-07388

**SOME PROPERTIES OF VARIANCE REDUCTION TECHNIQUES WHERE HYDROLOGICAL EXTREMES ARE ESTIMATED BY MONTE CARLO SIMULATION,**  
Institute of Hydrology, Wallingford (England). R. J. Moore, and R. T. Clarke.  
Water Resources Research, Vol. 14, No. 1, p 55-61, February 1978. 8 tab, 11 ref.

Descriptors: \*Streamflow, Water resources, \*Model studies, \*Mathematical models, \*Monte Carlo method, Regression analysis, Estimating, Estimating equations, Probability, Hydrology, \*Synthetic hydrology, \*Variance reduction, \*Hydrological extremes.

An estimate  $F$  of a water resource system's performance, when it is derived by simulation using synthetic sequences, is subject to at least three errors; first, model errors, arising from the approximation to the 'true' streamflow mechanism which the model represents; second, sampling errors in the model parameters  $\theta$  when they are calculated from the historic records; and third, errors introduced by the Monte Carlo calculation from which  $F$  is derived. This paper presented some observations on the effects of the first two types of error on the estimate  $F$  but concentrated on the application of variance reduction techniques to the derivation of Monte Carlo estimates  $F$  for given  $\theta$ . These techniques were, first, the use of control variates, and second, the use of antithetic variates. The application of the technique was illustrated by using some hypothetical examples of the calculation of probabilities of extreme hydrological events and of the calculation of reliability measures for a much oversimplified storage system. Considerable reduction in the variance of  $F$  resulted from the application of the control variate method; the reduction in Var  $F$  resulting from the use of antithetic variates was much less but still probably worth the small additional programming effort required. It was concluded that the promise of the control variate method suggests that it should be applied to assist in the efficient simulation of more realistic water resource systems than the trivial ones considered in this paper. (Sims-ISWS)  
W78-07391

**THE DISHONEST METHOD IN STREAM TEMPERATURE MODELING,**  
Bonneville Power Administration, Portland, OR.  
For primary bibliographic entry see Field 2D.  
W78-07392

**EFFLUENT MIXING ZONE IN A SHALLOW RIVER,**  
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.  
For primary bibliographic entry see Field 5B.  
W78-07483

**FREE SURFACE FLOW COMPUTATIONS BY CHARACTERISTICS,**  
Lanchester Polytechnic, Coventry (England). Dept. of Civil Engineering.  
K. Sivaloganathan.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY4, Proceedings Paper 13707, p 543-556, April 1978. 10 fig, 3 tab, 10 ref, 3 append.

Descriptors: \*Unsteady flow, \*Hydraulics, \*Nonuniform flow, \*Mathematics, \*Computer models, Streamflow routing, Channel morphology, Surface runoff, Methodology, \*St. Venant equations, \*Method of characteristics, Iterative formulation.

A characteristic method that used specified distances and a net consisting of continuous forward characteristics and broken backward characteristics was introduced. Direct and iterative formulations of the method were presented. The method yields depth and velocity hydrographs at predetermined distances from which depths and velocities on a predetermined rectangular grid can be readily obtained. Accurate computations are possible by the use of either formulation. Computations using this method were compared with computations using the iterative formulation of the characteristic grid method, and agreement was observed to be very close. The distance steps used in this method need not be equal and may be chosen in such a manner as to deal most effectively with the particular channel geometry and spatial distribution of lateral inflows. (Singh-ISWS)  
W78-07493

**UNIFIED PRESENTATION OF WEIR-AERATION DATA,**  
Karlsruhe Univ. (West Germany). Inst. fuer Hydromechanik.  
M. Markofsky, and H. Kobus.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY4, p 562-568, April 1978. 2 fig, 17 ref, 1 append.

Descriptors: \*Weirs, \*Aeration, \*Oxygenation, Air, Entrainment, Air entrainment, Recirculation, Mixing, Dissolved oxygen, Froude number, Reynolds number, Water quality, Oxygen, Flow, Nomograms.

The literature on reoxygenation studies on free overall weirs was reviewed with the main objective of investigating model scale effects. A nomogram was presented for constant values of  $(r-1)$  as a function of the nappe Froude and Reynolds numbers. Analysis of the nomogram indicated that small-scale Froude model studies tend to underestimate prototype reoxygenation, whereas laboratory experiments at prototype heights of fall tend to overestimate reoxygenation if no consideration of flow rate is made. Correction factors for temperature and water quality effects were examined. This nomogram can serve as a guide to the complicated interrelationship involved in the reoxygenation process and as a method for uniform presentation for comparison of data acquired in the future. (Sims-ISWS)  
W78-07494

**INVESTIGATION OF LEVEL FLUCTUATIONS IN CLOSED BODIES OF WATER ON THE BASIS OF STOCHASTIC MODELS OF THE ELEMENTS OF THE HYDROLOGIC BUDGET,**  
I. S. Zhdanova, V. Ye. Prival'skiy, and D. Ya. Ratkovich.  
Soviet Hydrology: Selected Papers, Vol. 15, No. 3, p 195-198, 1976. 2 fig, 1 tab, 14 ref. Translated from Trudy IV Vsesoyuznogo Gidrologicheskogo S'yezda, Vol. 5, p 117-125, 1975.

Descriptors: \*Water level fluctuations, \*Bodies of water, \*Model studies, Mathematical models, Stochastic processes, Hydrologic budget, Water levels, Forecasting, Runoff, Evaporation, Discharge(Water), Hydrology, \*Caspian Sea, \*USSR.

In earlier published investigations, the stochastic models of inflow and evaporation were assigned a priori. Here the experimental estimate of the stochastic model of inflow, obtained on the basis of an analysis of data for 371 points with a 40-year observation record on 289 rivers that are not fed by lakes, was used. The problem was to construct

## Field 2—WATER CYCLE

### Group 2E—Streamflow and Runoff

such a stochastic runoff model that would accurately reflect the observed patterns of succession of high-flow and low-flow years. The parameters of this process were determined from groups of realization formed according to the similarity of hydrologic parameters. Among these parameters, the runoff rate and its coefficient of variation, drainage-basin area, geographic location, type of climate, etc., were used. Study of available runoff observation records showed that the runoff rate should be selected as the characteristic criterion. It was found that, regardless of the runoff rate, the fluctuations in runoff probability from year to year can be described with sufficient accuracy for practical purposes by a stationary Markovian process with a two-dimensional distribution density. (Sims-ISWS)  
W78-07500

#### COMPUTATION OF THE PATTERN OF CURRENTS IN RIVERS AND NONSTRATIFIED RESERVOIRS,

I. A. Sherenkov.  
Soviet Hydrology: Selected Papers, Vol. 15, No. 3, p 203-208, 1976. 3 fig, 14 ref. Translated from Trudy IV Vsesoyuznogo Gidrologicheskogo S'yezda, Vol. 5, p 231-242, 1975.

Descriptors: \*Reservoirs, \*Rivers, \*Currents(Water), \*Model studies, Mathematical models, Equations, Flow, Velocity, Open channels, Lakes, Fluid friction, Hydraulics, Streams, Bodies of water, Distribution patterns.

Idealization of three-dimensional turbulent motion in watercourses and bodies of water in the form of a two-dimensional current in plan is very important for the solution of many applied problems. It is possible to pass to a plane problem, i.e., to the analysis of average vertical velocities, for a broad class of currents in rivers and reservoirs in the absence of density jumps along the vertical. This is achieved mathematically by integrating along depth the general Reynolds equations of turbulent motion and equations of turbulent diffusion with allowance for the dependence of the limits of integration of the depth of the bottom and the height of the free surface H on the horizontal coordinates. Flow in drainage bodies of water is a very complex pattern of motion of a stream in bounded space with variable depth. In plan one can identify transient streams (core of constant mass), eddy and stagnant regions, and flow and near-wall boundary layers. The pattern of currents is complicated considerably by wind action. Since horizontal turbulent exchange is the determining or very significant factor in such currents, methods must be developed for computing the pattern of currents that would allow for this factor, since computation of the pattern of currents after N.M. Bernadskiy and computations of marine currents (in the absence of drainage) either do not allow for horizontal turbulent, stresses, or regard them as a secondary factor. (Sims-ISWS)  
W78-07502

VARIATION OF DRAINAGE DENSITY IN A SMALL BRITISH COLUMBIA WATERSHED, Simon Fraser Univ., Burnaby (British Columbia). Dept. of Geography.  
For primary bibliographic entry see Field 4D.  
W78-07505

FLOODPLAIN DELINEATION USING LANDSAT-1 DATA, Pennsylvania State Univ., University Park. Space Science and Engineering Lab.  
For primary bibliographic entry see Field 4A.  
W78-07510

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUN-

TAINS AND PACIFIC NORTHWEST (EXECUTIVE SUMMARY), Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07563

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART B: CALIFORNIA (EXECUTIVE SUMMARY), Jones and Stokes Associates, Inc., Sacramento, CA.  
For primary bibliographic entry see Field 6G.  
W78-07564

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH WILDLIFE, PART B: CALIFORNIA (FINAL REPORT), Jones and Stokes Associates, Inc., Sacramento, CA.  
For primary bibliographic entry see Field 6G.  
W78-07565

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART B: CALIFORNIA (CASE STUDIES), Jones and Stokes Associates, Inc., Sacramento, CA.  
For primary bibliographic entry see Field 6G.  
W78-07566

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (FINAL REPORT), Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07567

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (ROCKY MOUNTAIN REGION CASE STUDIES), Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07568

ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (PACIFIC NORTHWEST REGION CASE STUDIES), Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07569

## 2F. Groundwater

RELATIONSHIP BETWEEN GROUNDWATER RESOURCES AND ENERGY PRODUCTION IN SOUTHWESTERN MISSOURI, Missouri Univ., Columbia. Dept. of Geology.  
For primary bibliographic entry see Field 2K.  
W78-07202

URANIUM-ISOTOPE VARIATIONS IN GROUNDWATERS OF THE FLORIDAN AQUIFER AND BOULDER ZONE OF SOUTH FLORIDA, Florida State Univ., Tallahassee. Dept. of Geology; and Geological Survey, Tallahassee, FL. Water Resources Div.  
For primary bibliographic entry see Field 5B.  
W78-07343

AVAILABILITY AND QUALITY OF GROUND WATER IN THE DRAIN-YONCALLA AREA, DOUGLAS COUNTY, OREGON, Geological Survey, Portland, OR. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-07347

PRELIMINARY DIGITAL MODEL OF THE ARIKAREE AQUIFER IN THE SWEETWATER RIVER BASIN, CENTRAL WYOMING, Geological Survey, Cheyenne, WY. Water Resources Div.  
W. B. Borchert.  
Water-Resources Investigations 77-107 (open-file report), September 1977. 19 p, 1 fig, 4 plates, 14 ref.

Descriptors: \*Groundwater resources, \*Model studies, \*Aquifer characteristics, \*Surface-groundwater relationships, \*Wyoming, Groundwater movement, Withdrawal, Water yield, Groundwater recharge, Hydraulic conductivity, Simulation analysis, Analytical techniques, \*Computer models, \*Sweetwater River Basin(Wyo), Arikaree aquifer, Central Wyoming.

In central Wyoming, Potentially large supplies of ground water are available in the Sweetwater River basin from the Arikaree aquifer, which consists of the upper part of the White River, the Arikaree, and the Ogallala Formations. A preliminary digital model was developed for the Arikaree aquifer using a small amount of poorly distributed data, an estimated distribution of recharge, and a conceptual model of the Arikaree aquifer flow system. Calibration of the model was based on reproduction of the potentiometric surface and the base flow of the Sweetwater River in November 1975. Calculated steady-state hydraulic heads were within 50 feet of the observed heads in about 98 percent of the nodes. The calculated leakage from the Arikaree aquifer to the Sweetwater River in the western area was within about 12 percent of the leakage determined by gain and loss studies. In order to develop a comprehensive digital model that would respond to hydraulic stress in nearly the same manner as the actual aquifer flow system, measured responses of the aquifer to stress are needed. Also needed are additional data on aquifer characteristics, recharge to the aquifer, and stream-aquifer relationships. (Woodard-USGS)  
W78-07351

WATER-LEVEL CHANGES IN WELLS ALONG THE WEST SIDE OF THE CEDAR CREEK ANTICLINE, SOUTHEASTERN MONTANA, Geological Survey, Helena, MT. Water Resources Div.  
For primary bibliographic entry see Field 4B.  
W78-07357

DESCRIPTION OF WELLS AT BEALE AIR FORCE BASE AND VICINITY, CALIFORNIA, Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 4B.  
W78-07358

ARTIFICIAL GROUND-WATER RECHARGE WITH CAPILLARITY, Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 4B.  
W78-07365

HYDROGEOLOGY OF METROPOLITAN CHRISTCHURCH, New Zealand Geological Survey, Christchurch.  
For primary bibliographic entry see Field 4B.  
W78-07368

FLOW TO A LEAKY ART... BLE DISCH... Govind Ball... Technology, ... tural Engineer... C. S. Jaiswal, ... Ground Water... April 1978. 4

Descriptors: aquifers, \*Water wells, Unst... Curves, Tr... \*Nonpenetr... \*Variable di...

A differentia... transient flo... finite leaky... was formula... state flow w... in leaky arte... ble discharge... case of expo... solution was... mathematica... W78-07378

POROUS M... MOUNDS, I... Iowa State U... S. F. Mousa... Soil Science... No. 3, p 160

Descriptors: \*Groundwa... Testing, La... Infiltration... Sand mode...

To test the... groundwa... and circula... tory model... silica sand... and a 60%... recharge f... various dis... were com... heights. Th... good agree... two-dimen... symmetric... W78-07387

THEORY... MOVING... HYDROD... Cold Regi... Hanover, ... Y. Nakano... Water Res... 134, Febru...

Descriptors: analysis, \*Boundari... tions, Gro... ries.

The exact... between u... well as a v... for n... saturated... introduced... intersecting... substituted... finite widt... cept was... The feasib... it was ap... ference s...

**FLOW TO A NONPENETRATING WELL IN A LEAKY ARTESIAN AQUIFER WITH VARIABLE DISCHARGE.**

Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Engineering.  
C. S. Jaiswal, and H. S. Chauhan.  
Ground Water, Vol. 16, No. 2, p 119-125, March-April 1978. 4 fig, 2 tab, 16 ref.

Descriptors: \*Penetration, \*Leakage, \*Artesian aquifers, \*Pumping, \*Mathematical models, \*Water wells, Groundwater movement, Equations, Unsteady flow, Mathematical studies, Curves, Transmissivity, Storage coefficient, \*Nonpenetrating wells, \*Leaky aquifers, \*Variable discharge, Spherical coordinates.

A differential equation for axisymmetric radial transient flow to a nonpenetrating well in an infinite leaky aquifer in spherical coordinate system was formulated. A general solution for nonsteady-state flow was obtained for nonpenetrating wells in leaky artesian aquifers with a general time variable discharge function, as well as for the specific case of exponential decay discharge function. The solution was expressed in terms of standard mathematical functions. (Visocky-ISWS)  
W78-07378

**POROUS MEDIA TESTS OF GROUNDWATER MOUNDS.**

Iowa State Univ., Ames. Dept. of Agronomy.  
S.-F. Mousavi, and D. Kirkham.  
Soil Science Society of America Journal, Vol. 125, No. 3, p 160-164, March 1978. 8 fig, 14 ref.

Descriptors: \*Model studies, \*Porous media, \*Groundwater recharge, Pit recharge, Equations, Testing, Laboratory tests, Hydraulic conductivity, Infiltration, Groundwater mounds, Glass beads, Sand models, Gravel.

To test the theoretical equations for the shapes of groundwater mounds formed under rectangular and circular recharge basins, two Plexiglas laboratory models were constructed. Glass beads, white silica sand, and gravel were used as porous media, and a 60% glycerol-water mixture was used as the recharge fluid. The mound heights, measured at various distances from the centers of the mounds, were compared with the theoretical mound heights. The experimental mound heights showed good agreement with theoretical ones, both for the two-dimensional and the three-dimensional axial symmetric mounds. (Visocky-ISWS)  
W78-07387

**THEORY AND NUMERICAL ANALYSIS OF MOVING BOUNDARY PROBLEMS IN THE HYDRODYNAMICS OF POROUS MEDIA.**

Cold Regions Research and Engineering Lab., Hanover, NH.  
Y. Nakano.  
Water Resources Research, Vol. 14, No. 1, p 125-134, February 1978. 4 fig, 5 tab, 14 ref.

Descriptors: \*Mathematical studies, \*Theoretical analysis, \*Numerical analysis, \*Boundaries (Surfaces), \*Porous media, Equations, Groundwater movement, Moving boundaries.

The exact mathematical description of a boundary between unsaturated flow and saturated flow as well as a wetting front were obtained. A new concept for numerical analysis of flow in a partly unsaturated and partly saturated porous medium was introduced. A boundary of infinitesimal width intersecting the unsaturated and saturated parts was substituted by an artificial transitional zone of finite width for computational simplicity. The concept was proved to be theoretically justifiable. The feasibility of the concept was demonstrated as it was applied to a two-dimensional finite difference solution of a special problem of column

drainage, for which an analytical solution was obtained. (Visocky-ISWS)  
W78-07389

**GROUNDWATER RECHARGE AND COASTAL DISCHARGE FOR THE NORTHWEST COAST OF THE ISLAND OF HAWAII: A COMPUTERIZED WATER BUDGET APPROACH.**

Hawaii Univ., Honolulu. Water Resources Research Center.  
B. Y. Kanchiro, and F. L. Peterson.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 803. Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 110, July 1977. 83 p, 25 fig, 10 tab, 23 ref, 3 append. OWRT A-067-HI(1), 14-31-0001-6012.

Descriptors: \*Water budget, \*Groundwater recharge, \*Computer models, Hydrogeology, Groundwater tides, Coastal discharge, Fourier analysis, Ghyben-herzberg aquifer, Lecolazet method, Computer maps, \*Hawaii Island, \*Hawaii, Model studies.

Basic objectives were to determine the average annual recharge to the groundwater and the fresh groundwater discharge at the coastline, as well as the aquifer characteristics for an arid area located on the northwest coast of Hawaii island between Kiholo Bay in the south and Puako in the north, and encompassing the land from the coast to approximately the 762-m (2,500-ft) elevation level. Of equal importance was the development of methodologies, namely, a computerized water budget and groundwater tidal analyses, to calculate these quantities. The probable recharge to the groundwater was computed to be 143.83 x 10 to the 6th power m<sup>3</sup>/yr (38 bil gal/yr). Due to the lack of hydrologic data, a range of values was determined, with the maximum average annual recharge being 264.95 x 10 to the 6th power m<sup>3</sup> (70 bil gal) and the minimum 719.15 x 10 to the 5th power m<sup>3</sup> (10 bil gal). Since there are 26 km (16 miles) of coastline in this area, this implies a probable average daily flux of 15,006 m<sup>3</sup>/km (6.38 mil gal/mile) of coastline. Three calculations were obtained for the hydraulic conductivity of the groundwater aquifer in the coastal region: two by tidal analysis, and a third based on the coastal discharge as determined by the water budget. The Werner and Noren method of tidal analysis gave an average value for Kz (hydraulic conductivity time average saturated depth of aquifer) in the vicinity of 'Anaeho'omalu Bay of 585,270 m<sup>2</sup>/day (6.3 x 10 to the 6th power ft<sup>2</sup>/day); the method by Cox gave a value for K in the same area of 1,027 m/day (3,369 ft/day). The coastal flux method gave a value for K of 2,771 m/day (9,092 ft/day).  
W78-07394

**HANDBOOK-INDEX OF HAWAII GROUNDWATER AND RESOURCES DATA, EXTRACTED FROM REPORTS OF THE WATER RESOURCES RESEARCH CENTER, UNIVERSITY OF HAWAII, VOLUME I.**

Hawaii Univ., Honolulu. Water Resources Research Center.  
For primary bibliographic entry see Field 7C.  
W78-07395

**HYDROLOGICAL STUDIES ON A SMALL BASIN ON THE CANADIAN SHIELD.**

Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.  
For primary bibliographic entry see Field 2H.  
W78-07406

**BOUNDARY CONDITIONS IN MODELING WATER FLOW IN UNSATURATED SOILS.**

Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.  
For primary bibliographic entry see Field 2G.  
W78-07503

**NUTRIENT, BACTERIAL, AND VIRUS CONTROL AS RELATED TO GROUND WATER CONTAMINATION.**

Robert S. Kerr Environmental Research Lab., Ada, OK.  
For primary bibliographic entry see Field 5B.  
W78-07571

**GROUNDWATER TRACING WITH POST SAMPLING ACTIVATION ANALYSIS USING BROMIDE AND IODIDE IONS INJECTED SIMULTANEOUSLY INTO A SHALLOW-WELL SYSTEM.**

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.  
For primary bibliographic entry see Field 5B.  
W78-07683

**2G. Water In Soils****DETERMINATION OF TRACE ELEMENTS IN THE ENGLISH COULEE SYSTEM: PRESENCE DUE TO EXTENDED LIGNITE BURNING.**

North Dakota Univ., Grand Forks. Dept. of Physics.  
For primary bibliographic entry see Field 5A.  
W78-07208

**PROTONATION OF ORGANIC BASES IN CLAY-WATER SYSTEMS.**

Environmental Research Lab., Athens, GA.  
For primary bibliographic entry see Field 5B.  
W78-07364

**DIELECTRIC CONSTANT AND ELECTROCONDUCTANCE OF SOME DRY FROST-PRONE SOILS.**

Rutgers - The State Univ., New Brunswick, NJ. Dept. of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 2C.  
W78-07369

**EFFECTS OF WETTING AGENTS ON WATER INFILTRATION INTO WATER-REPELLENT COAL MINE SPOILS.**

Texas A and M Univ., El Paso. Research Center.  
For primary bibliographic entry see Field 5G.  
W78-07370

**STEADY-STATE SOLUTE CONVECTION IN TWO DIMENSIONS WITH NONUNIFORM INFILTRATION.**

Wisconsin Univ.-Madison. Dept. of Soil Science.  
V. Batu, and W. R. Gardner.  
Soil Science Society of America Journal, Vol. 42, No. 1, p 18-22, January-February 1978. 6 fig, 16 ref.

Descriptors: \*Solute, \*Percolation, \*Infiltration, \*Model studies, Mathematical models, Soil water, Soil water movement, Flow, Unsaturated flow, Non-uniform flow, Soils, Leaching, Leachate, Irrigation, Moisture content, Convection, Equations, Soil science.

The steady-state unsaturated flow equation in two dimensions was solved for an exponential unsaturated conductivity using the Kirchhoff transformation. Streamlines, travel times, and isochrones were calculated for an infiltration rate which is a piece-wise linear function of horizontal coordinate. Results were compared with the equivalent solutions for a saturated soil. In addition to solutions in dimensionless form, an example was presented for Plainfield sand. The results confirmed that surface variations in infiltration rate may be propagated to a considerable depth, particularly in sandy soils. This may account, in part, for the variability in solute leaching frequently observed in the field. (Sims-ISWS)  
W78-07381



## Field 2—WATER CYCLE

### Group 2G—Water In Soils

#### APPENDIX E TO CORRELATION OF DUAL-CHANNEL AIRBORNE IR DATA WITH SOIL MOISTURE MEASUREMENTS.

Development and Resources Transportation Co., Silver Spring, MD.

L. A. LeSchack, N. K. Del Grande, S. I. Outcalt, J. L. Lewis, and C. Jenner.

Development and Resources Transportation Co., Final Report to NOAA, National Environmental Satellite Service, March 1975 (Reprinted Feb 1978). 35 p, 6 fig, 8 tab, 13 ref. NOAA-6-35191.

Descriptors: \*Soil moisture, \*Measurement, \*Infrared, Soil mechanics, Ground truth data, Airborne.

To determine whether a quantitative relationship exists between soil moisture and surface temperatures as measured by airborne IR techniques, a survey was conducted at a NOAA test site at Scipio Center, New York, on 13 October 1972. The survey and data analysis are discussed in LeSchack et al. (1975), the body of the report for which the following is an Appendix. Thirty-eight soil moisture measurements were made along a 7-km profile that traversed six different soil surfaces. Concurrently, 5- and 10 micro meter IR data were simultaneously recorded, along with multi-spectral photography, from an altitude of 1700 m above mean terrain, at 1528 hrs solar time. Since the surface temperature variation as a function of soil moisture was expected to be small, careful calibration of the recorded brightness temperature values and accurate corrections for extraneous factors were considered necessary. To accomplish this, a new airborne method for making such surface temperature measurements was developed. (NOAA)

W78-07383

#### DISPERSION IN SOIL COLUMNS: EFFECT OF BOUNDARY CONDITIONS AND IRREVERSIBLE REACTIONS.

Connecticut Agricultural Experiment Station, New Haven.

J.-Y. Parlange, and J. L. Starr.

Soil Science Society of America Journal, Vol. 42, No. 1, p 15-18, January-February 1978. 4 fig, 17 ref.

Descriptors: \*Dispersion, \*Soils, \*Model studies, \*Mathematical models, Adsorption, Convection, Diffusion, Soil water, Solutes, Aqueous solutions, Laboratory tests, Theoretical analysis, Soil science, Soil columns.

A closed form approximate analytical solution was provided which describes the transport of a solute in a soil column. The effects of convection, dispersion, and adsorption were included. The latter can include both linear adsorption and first- or zero-order reactions. The effect of the finite length of a soil column on the miscible displacement of the solute was discussed in detail. It was shown in particular that the standard solution used in the past is accurate to describe the breakthrough curve but not the profile within the column. (Sims-ISWS)

W78-07386

#### POROUS MEDIA TESTS OF GROUNDWATER MOUNDS.

Iowa State Univ., Ames. Dept. of Agronomy.

For primary bibliographic entry see Field 2F.

W78-07387

#### THEORY AND NUMERICAL ANALYSIS OF MOVING BOUNDARY PROBLEMS IN THE HYDRODYNAMICS OF POROUS MEDIA.

Cold Regions Research and Engineering Lab., Hanover, NH.

For primary bibliographic entry see Field 2F.

W78-07389

#### A VARIATIONAL INEQUALITY METHOD APPLIED TO FREE SURFACE SEEPAGE FROM A TRIANGULAR DITCH.

California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.

For primary bibliographic entry see Field 4A.

W78-07390

#### MONITORING IN THE ZONE OF AERATION.

SCS Engineers, Long Beach, CA.

For primary bibliographic entry see Field 5A.

W78-07470

#### SOLUTE TRANSPORT THROUGH SOIL WITH NONUNIFORM WATER CONTENT.

New Mexico State Univ., University Park. Dept. of Agronomy.

F. DeSmedt, and P. J. Wierenga.

Soil Science Society of America Journal, Vol. 42, No. 1, p 7-10, January-February 1978. 4 fig, 16 ref.

EPA-S-803156.

Descriptors: \*Solute, \*Soil water movement, \*Moisture content, \*Model studies, Mathematical models, Theoretical analysis, Analytical techniques, Equations, Soil water, Leachate, Effluents, Soil science, Breakthrough curves, Miscible displacement.

An approximate analytical solution was presented for steady flow of salt through soil with a nonuniform distribution of the water content. The solution was in good agreement with a numerical computer solution provided by the CSMP simulation language. Both solutions also agreed with the analytical solution for soils with a uniform distribution of the water content. It was shown that effluent curves from soil profiles, with the same average water content and leached at the same steady rate, are basically the same and thus independent of the variation of the water content in such profiles. (Sims-ISWS)

W78-07496

#### TRANSIENT-AND STEADY-FLOW EXPERIMENTS TESTING THEORY OF WATER FLOW IN SATURATED BENTONITE.

Commonwealth Scientific and Industrial Research Organization, Canberra City (Australia). Div. of Environmental Mechanics.

D. E. Smiles.

Soil Science Society of America Journal, Vol. 42, No. 1, p 11-14, January-February 1978. 5 fig, 1 tab, 12 ref.

Descriptors: \*Soil water movement, \*Flow, \*Model studies, Mathematical models, Laboratory tests, Stratified flow, Steady flow, Unsteady flow, Darcys law, Clays, Bentonite, Hydraulic conductivity, Moisture content, Diffusivity, Soil science.

The theory of water flow in a saturated, swelling clay has been criticized recently. This criticism concerns possible effects on the material characteristics of particle re-orientation during transient flow, as well as suggestions that the flux equation (Darcy's law) may be inappropriate to such systems. This paper examined these problems by comparing data from transient and steady-flow experiments with bentonite. The data from all experiments are mutually consistent within the experimental error. It was concluded that Darcy's law is valid for this material and that the conductivity/water content, and water content/suction relationships are well defined. (Sims-ISWS)

W78-07497

#### EFFECTS OF CLAY TYPE AND CONTENT, EXCHANGEABLE SODIUM PERCENTAGE, AND ELECTROLYTE CONCENTRATION ON CLAY DISPERSION AND SOIL HYDRAULIC CONDUCTIVITY.

Agricultural Research Service, Riverside, CA. Salinity Lab.

H. Frenkel, J. O. Goertzen, and J. D. Roades.

Soil Science Society of America Journal, Vol. 42, No. 1, p 32-39, January-February 1978. 9 fig, 2 tab, 31 ref.

Descriptors: \*Hydraulic conductivity, \*Electrical conductance, \*Soils, \*Clays, Laboratory tests, Soil water movement, Soil water, Alkaline soils, Leachate, Salts, Water quality, Soil types, Montmorillonite, Kaolinite, Percolation, Infiltration, Soil science, Vermiculite.

The hydraulic conductivities and gradients along soil columns packed with montmorillonitic, vermiculitic, an kaolinitic soils adjusted to different levels of exchangeable sodium were determined at different salt concentrations. The data showed that plugging of pores by dispersed clay particles is a major cause of reduced soil hydraulic conductivity for surface soils irrigated with sodic waters. (Sims-ISWS)

W78-07498

#### MULTIPLE TENSIO-METER FLUSHING SYSTEM.

Agricultural Research Service, Riverside, CA. Salinity Lab.

M. J. Huber, and C. Dirksen.

Soil Science Society of America Journal, Vol. 42, No. 1, p 168-170, January-February 1978. 1 fig, 5 ref.

Descriptors: \*Tensiometers, \*Soil water, \*Instrumentation, Equipment, Valves, Air, Bubbles, Irrigation, Soil science, Flushing, Flushing equipment.

A system for simultaneous flushing of a large number of tensiometers was described. It includes a multiple shutoff valve and a manometer with movable bottom. Flushing procedures were described; they are fast and simple. It can be used with any direction of installation of tensiometers or tubing, for instance, when all tubing is kept below the soil surface to reduce temperature fluctuations. A concentric tubing arrangement reduces air diffusion into the measuring tubing. The system offers potential for improved data quality and reduced need for flushing. (Sims-ISWS)

W78-07499

#### BOUNDARY CONDITIONS IN MODELING WATER FLOW IN UNSATURATED SOILS.

Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.

H. Zaradny.

Soil Science, Vol. 125, No. 2, p 75-82, February 1978. 11 fig, 20 ref.

Descriptors: \*Soils, \*Model studies, \*Soil water movement, Soil moisture, Mathematical models, Equations, Moisture content, Sands, Boundaries(Property), Flow, \*Unsaturated soils, Richards equation, Soil water.

Simultaneous physical and mathematical modeling was employed to prove that the Richards equation holds true for problems of water flow in unsaturated sand soils. This was shown through good agreement between computation results and data obtained from a physical model. Fine sand was used in the model, and changes in the water content were measured with Am 241. Good results were obtained upon assuming the boundary condition along the supply line to be in the form of the derivative of water content. It also was found that the widely accepted boundary condition, namely that water content is constant at the supply boundary, can bring about erroneous conclusions. Good efficiency was achieved in the computations upon the assumption of a time variable increment which can be determined with a criterion derived through numerical experiments. (Lee-ISWS)

W78-07503

A SIMPLE MEASURE SOILS. Allahabad Univ. For primary b W78-07504

RATE OF AN NITRATE LE. Colorado Sta. Agricultural E. For primary b W78-07520

DERIVATION ACCOUNTING PROPERTIES WEATHER SYSTEM. National Wea. fice of Hydro. B.L. Armstro. NOAA Tech. 37, March 197

Descriptors: ties, \*River Model studie

The method the initial soil the National System. The sistent betw this study, e runoff mode procedure re Parameters Stillwater, O tion program and useful s counting par effectiveness using it in co from asin h derived from initial simul found only b be computer model. By t trial and err and a consid puter time w W78-07551

NITRATE METHODS Texas A an Soil and Cr Experiment For primary W78-07609

EFFECT O ON DISTR NITROGEN Texas Agric For primary W78-07610

VARIABLE WITHIN DI California U For primary W78-07612

FIELD M DENITRIFI FLUENCED ORGANIC California U Water Reso For primary

## WATER CYCLE—Field 2

### Lakes—Group 2H

#### A SIMPLE LABORATORY APPARATUS TO MEASURE RELATIVE ERODIBILITY OF SOILS.

Allahabad Univ. (India).  
For primary bibliographic entry see Field 2J.  
W78-07504

#### RATE OF AMMONIUM NITRIFICATION AND NITRATE LEACHING IN SOIL COLUMNS,

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5B.  
W78-07520

#### DERIVATION OF INITIAL SOIL MOISTURE ACCOUNTING PARAMETERS FROM SOIL PROPERTIES FOR THE NATIONAL WEATHER SERVICE RIVER FORECAST SYSTEM,

National Weather Service, Silver Spring, MD. Office of Hydrology.  
B. L. Armstrong.  
NOAA Technical Memorandum NWS HYDRO 37, March 1978. 55 p, 4 fig, 8 tab, 12 ref.

Descriptors: \*Soil moisture, \*Soil physical properties, \*River forecasting, Runoff, \*Oklahoma, Model studies.

The method developed in this research provides the initial soil moisture accounting parameters for the National Weather Service River Forecast System. The parameters will be physically consistent between basins and subareas of basins. In this study, each parameter used in the conceptual runoff model is investigated, and a computational procedure relating to soil properties is developed. Parameters are derived (for Council Creek near Stillwater, Okla.) and used in a computer verification program. This study demonstrates a practical and useful solution for obtaining soil moisture accounting parameters from soil properties. The effectiveness of this procedure can be increased by using it in conjunction with the parameters derived from asin hydrographs. Although the parameters derived from soil properties produce an excellent initial simulation, the optimum parameters may be found only by a trial and error approach that must be computerized because of the complexity of the model. By the use of this method, the number of trial and error attempts will be greatly decreased, and a considerable savings of man-hours and computer time will result. (NOAA)  
W78-07551

#### NITRATE MOVEMENT IN CLAY SOILS AND METHODS OF POLLUTION CONTROL,

Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences; and Texas Agricultural Experiment Station, College Station.  
For primary bibliographic entry see Field 5B.  
W78-07609

#### EFFECT OF THREE IRRIGATION SYSTEMS ON DISTRIBUTION OF FERTILIZER NITRATE NITROGEN IN SOIL,

Texas Agricultural Experiment Station, Lubbock.  
For primary bibliographic entry see Field 5B.  
W78-07610

#### VARIABILITY OF NITRATE LEACHING WITHIN DEFINED MANAGEMENT UNITS,

California Univ., Riverside.  
For primary bibliographic entry see Field 5B.  
W78-07612

#### FIELD MEASURED FLUX OF VOLATILE DENITRIFICATION PRODUCTS AS INFLUENCED BY SOIL WATER CONTENT AND ORGANIC CARBON SOURCE,

California Univ., Davis. Dept. of Land, Air and Water Resources.  
For primary bibliographic entry see Field 5G.

W78-07613

#### SOIL NITRATE CONCENTRATIONS IN CORN PLOTS TREATED WITH ISOTOPICALLY LABELED NITROGEN FERTILIZER,

California Univ., Davis. Dept. of Land, Air and Water Resources.  
For primary bibliographic entry see Field 5B.  
W78-07614

#### THEORETICAL AND EXPERIMENTAL OBSERVATIONS OF WATER AND NITRATE MOVEMENT BELOW A CROP ROOT ZONE,

California Univ., Davis. Dept. of Land, Air and Water Resources.  
For primary bibliographic entry see Field 5B.  
W78-07615

#### MINIMIZING SALT IN RETURN FLOW BY IMPROVING IRRIGATION EFFICIENCY,

Agricultural Research Service, Riverside, CA. Salinity Lab.  
For primary bibliographic entry see Field 5G.  
W78-07616

#### EFFECT OF IRRIGATION SYSTEMS ON WATER USE EFFICIENCY AND SOIL WATER SOLUTE CONCENTRATIONS,

Texas Agricultural Experiment Station, Lubbock.  
For primary bibliographic entry see Field 5G.  
W78-07620

#### AREAL PREDICTIONS OF SOIL WATER FLUX IN THE UNSATURATED ZONE,

Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.  
A. W. Warrick.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 225-231, May 16-19, 1977. 8 fig, 14 ref.

Descriptors: Soil water, \*Soil water movement, Soils, \*Soil investigations, Irrigation, \*Salinity, Hydraulic conductivity, \*Areal.

Irrigation, salinity a potential ground or surface water pollutants are intimately related to water and solute movement in the soil profile. Ideally, soil water fluxes and water composition are managed in order to provide a desirable plant growing environment and/or acceptable quantities and qualities of drainage water. The problem of predicting or averaging such fluxes is very difficult due to the intrinsic variability of the soil's physical and chemical properties. In this study, predictions of soil water flux are made accounting for the spatial variability of the soil water parameters. Calculations are made using field-measured distributions of conductivity and soil water tension -- water content relationships for Panoche loam and Pima clay loam soils. In the second set of calculations, flux distributions are found using the more cumbersome, finite difference solution to the nonlinear moisture flow equation. This allows inclusion of more realistic boundary conditions as well as plant water uptake. The results are a step towards finding the most effective way of determining and expressing water flux as a function of time. Also, addressed are reliability of areal predictions and measurements. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07630

#### WATER DISTRIBUTION PATTERNS FOR SPRINKLER AND SURFACE IRRIGATION SYSTEMS,

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.  
For primary bibliographic entry see Field 3F.  
W78-07631

#### APPLICATION OF MODERN IRRIGATION TECHNOLOGY IN THE MESILLA VALLEY, NEW MEXICO,

New Mexico State Univ., University Park. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 3C.  
W78-07634

#### SOIL STRENGTH AND SOIL TEMPERATURE: THEIR EFFECTS ON ROOT GROWTH OF TALL FESCUE,

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.  
D. M. Casnoff.

Available from the National Technical Information Service, Springfield, VA. 22161 as PB-282 101, Price codes: A08 in paper copy, A01 in microfiche. Master of Science Thesis, Pennsylvania State University, University Park, Dept. of Agronomy. May 1978. 152 p, 90 tab, 22 fig, 51 ref, 1 append. OWRT C-6249(No. 5222)(1).

Descriptors: \*Root development, \*Soil temperature, Soils, \*Soil strength, Moisture content, \*Fescues, Density, Plant rates, Growth stages, Greenhouses, \*Soil-water-plant relationships, \*Root length tip, Interaction.

Root growth and morphology of tall fescue were measured to determine the significant interactions and main effects caused by temperature, time, and soil strength. The following results were obtained: (1) the temperature x time x soil strength interaction was significant for primary root length and number of first order laterals; (2) the temperature x time interaction was significant for primary/total root length and total shoot length; (3) a significant temperature main effect and soil strength x time interaction was found for total root length; (4) significant soil strength x temperature and soil strength x time interactions were found for number of primaries; (5) significant temperature, soil strength, and time main effects were found for first order lateral root length; and (6) a significant temperature x soil strength x time interaction was found for total root length per root tip. The following conclusions were made: (1) a soil strength x time interaction will have to be dealt with in an overall root growth model; (2) the soil strength x temperature interaction was not important for tall fescue root growth; and (3) the significant variability in the measured root parameters, which caused many of the resulting interactions, was likely explained by either transplanting effects or genetic variability. (Sink-Penn St)  
W78-07688

## 2H. Lakes

#### WIND POWERED ARTIFICIAL AERATION OF NORTHERN PRAIRIE LAKES,

North Dakota State Univ., Fargo. Dept. of Mechanical Engineering.  
For primary bibliographic entry see Field 8C.  
W78-07201

#### THE RELATIONSHIP OF LAKE QUALITY TO SPECIFIC URBANIZATION STRESSES,

Massachusetts Univ., Waltham. Dept. Environmental Sciences.  
For primary bibliographic entry see Field 5C.  
W78-07204

#### AN ANALYTICAL EVALUATION OF THE UTILIZATION AND MANAGEMENT OF WATER RESOURCES IN THE LAKE METIGOSHE WATERSHED, NORTH DAKOTA,

North Dakota State Univ., Fargo. Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W78-07209

## Field 2—WATER CYCLE

### Group 2H—Lakes

#### THE EFFECTS OF DIURNAL MIXING ON THERMAL STRATIFICATION OF STATIC IMPOUNDMENTS,

Auburn Univ., AL. Dept. of Mechanical Engineering.

R. I. Hirshburg, J. S. Goodling, and G. Maples. Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 569. Price codes: A02 in paper copy, A01 in microfiche. American Water Resources Association Water Resources Bulletin, Vol. 12, No. 6, December 1976, p. 1151-1159. 2 fig, 13 ref. OWRT A-031-ALA(3).

Descriptors: \*Impoundments, Thermal mixing, Diurnal variations, Stratification, \*Thermal stratification, Thermal pollution, Model studies, Forecasting, Temperature distribution, Distribution patterns, Energy transfer.

The time variation in the temperature distribution of a static water impoundment is predicted. The body of water is modeled as a discrete number of horizontally isothermal layers and the energy equation is solved using an implicit numerical scheme. Vertical energy transport mechanisms included are solar absorption, molecular diffusion, and convective mixing due to nocturnal turnover. The latter mechanism, called diurnal mixing, is found to have a profound effect on the stratification, particularly in the epilimnion patterns for a typical deep static impoundment. W78-07210

#### HYDRAULIC MODELING OF MIXING IN STRATIFIED LAKES,

Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering. For primary bibliographic entry see Field 5B. W78-07218

#### THE IMPACT OF THE 1975 BONNET CARRE SPILLWAY OPENING ON EPIFAUNAL INVERTEBRATES IN SOUTHERN LAKE PONTCHARTRAIN,

New Orleans Univ., LA. Dept. of Biological Sciences. For primary bibliographic entry see Field 5C. W78-07219

#### INVENTORY OF LAKE ONTARIO INLETS AND HARBORS: NIAGARA RIVER TO STONY CREEK,

State Univ. of New York at Buffalo. Dept. of Civil Engineering.

R. D. Crisman, and J. U. Opata. Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 811. Price codes: A12 in paper copy, A01 in microfiche. New York Sea Grant Institute, Report NYSSGP-RS-76-026, December, 1976. 251 p, 86 fig, 40 tab, 12 ref. \$3.00.

Descriptors: \*New York, \*Lake Ontario, \*Census, \*Harbors, \*Inlets(Waterways), Inland waterways, Coastal structures, Channels, Lakes, Commercial fishing, Sport fishing, Marinas, Boat-launching ramps.

An inventory was conducted to determine the capacities and services of existing boating facilities, to investigate sites for future expansion, and to make recommendations for expansion. Sixty-one inlets and harbors were investigated, of which, three were federally maintained as commercial harbors, four were federally maintained as small boat harbors, 19 support some type of recreational boating activity, and 35 support no boating activity. The one feature characteristic to nearly all of the inlets, except for the larger tributaries, is a barrier beach. Forty-four of the inlets and harbors and some type of barrier beach formation. Based on an analysis of the present supply of boating facilities and previous recreational boating demand projections, it is recommended that 300

additional mooring and/or slips and 50 additional simultaneous launchings be provided by 1980. Recommendations for the distribution of these additional facilities, either by expansion or construction of new facilities, throughout the inventory area are presented. (Steiner-Mass) W78-07225

#### PLANNING GUIDELINES FOR RESIDENTIAL AND PATH DEVELOPMENT IN MICHIGAN'S SAND DUNES AND WETLANDS.

Mann (Roy) Associates, Inc., Cambridge, MA. For primary bibliographic entry see Field 4A. W78-07227

#### STABLE NITROGEN-CONTAINING DISSOLVED ORGANIC SUBSTANCE IN LAKE SCHOEHESE AND IN CULTURES OF ALGAE (IN GERMAN),

Bayerische fuer Landesamt Wasserwirtschaft, Munich (West Germany). For primary bibliographic entry see Field 5B. W78-07260

#### NITROGEN TRANSFORMATION IN LAKES,

Danish Soil Conservation Service, Viborg. Research Dept.

For primary bibliographic entry see Field 5C. W78-07262

#### EULIMNION, AN ORIGINAL PLACE OF NEW FORMS,

Lund Univ. (Sweden). Limnological Inst. For primary bibliographic entry see Field 5C. W78-07285

#### WEST POINT LAKE POSTIMPOUNDMENT STUDY,

Environmental Protection Agency, Athens, GA. Surveillance and Analysis Div. For primary bibliographic entry see Field 5C. W78-07287

#### LAND USE AND POLLUTION PATTERNS ON THE GREAT LAKES,

Cold Regions Research and Engineering Lab., Hanover, NH. For primary bibliographic entry see Field 5B. W78-07288

#### A GENERALIZED WATER QUALITY MODEL FOR EUTROPHIC LAKES AND RESERVOIRS,

Battelle Pacific Northwest Lab., Richland, WA. For primary bibliographic entry see Field 5C. W78-07290

#### RESTORATION OF LOWER ST. REGIS LAKE (FRANKLIN COUNTY, NEW YORK),

New York State Dept. of Health, Albany. Environmental Health Center. For primary bibliographic entry see Field 5G. W78-07291

#### THE PROBLEM OF THE SALINITY INCREASE IN LAKE QARUN (EGYPT) AND A PROPOSED SOLUTION,

Alexandria Inst. of Oceanography Fisheries (Egypt). For primary bibliographic entry see Field 5C. W78-07305

#### THE RELATION BETWEEN ADENOSINE TRIPHOSPHATE AND MICROBIAL BIOMASS IN DIVERSE AQUATIC ECOSYSTEMS,

California Univ., Davis. Div. of Environmental Studies. For primary bibliographic entry see Field 5C. W78-07306

#### SEDIMENTARY RECORD OF HEAVY METALS AND POLYCYCLIC AROMATIC HYDROCARBONS IN LAKE CONSTANCE (IN GERMAN),

Heidelberg Univ. (West Germany). Lab. fuer Seimentforschung. For primary bibliographic entry see Field 5B. W78-07307

#### RADIONUCLIDE CONCENTRATIONS IN THE ARKANSAS RIVER UPSTREAM AND DOWNSTREAM FROM THE NUCLEAR 1 POWER GENERATING FACILITY,

Arkansas State Univ., University. Dept. of Physical Sciences. For primary bibliographic entry see Field 5B. W78-07320

#### PRODUCTIVITY OF RED-WINGED BLACKBIRDS IN PRAIRIE POTHOLE HABITAT,

Fish and Wildlife Service, Jamestown, ND. Northern Prairie Wildlife Research Center. For primary bibliographic entry see Field 2I. W78-07339

#### HYDRAULICS OF SHEET FLOW IN WETLANDS,

Florida Univ., Gainesville. Dept. of Civil Engineering. For primary bibliographic entry see Field 8B. W78-07340

#### FLOOD-HAZARD STUDY--100-YEAR FLOOD STAGE FOR LUCERNE LAKE, SAN BERNARDINO COUNTY, CALIFORNIA,

Geological Survey, Menlo Park, CA. Water Resources Div. For primary bibliographic entry see Field 4A. W78-07359

#### HYDROLOGICAL STUDIES ON A SMALL BASIN ON THE CANADIAN SHIELD.

Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs. Available from the National Technical Information Service, Springfield, VA 22161 as AECL-5041. Price codes: A99 in paper copy, A01 in microfiche. Report AECL-5041, September 1975. 768 p. P.J. Barry, editor.

Descriptors: \*Evaporation, \*Lakes, \*Lake basins, \*Canada, Watersheds(Basins), Groundwater, Surface waters, On-site investigations, Surveys, Sediments, Vegetation, Precipitation(Atmospheric), Model studies, Mathematical models, Tritium, Water balance, Runoff, Weirs, Hydrogeology, Meteorology, \*Perch Lake(Ontario).

A final summary report is presented of a series of studies carried out in the Perch Lake basin between 1965 to 1974 as a contribution to the International Hydrological Decade. Perch Lake is a small sub-basin of the Ottawa River on the property of the Chalk River Nuclear Laboratories about 200 km west northwest of Ottawa. The report consisted of three chapters and six annexes. The first two chapters summarized, respectively, the results of evaluations of techniques commonly used to estimate (1) lake evaporation, and (2) groundwater contributions to the lake water budget. Particular emphasis was placed on those techniques conveniently referred to as 'nuclear'. In Chapter III proposals were discussed for continuing hydrological studies in the basin to develop better methods of estimating evaporation and groundwater flow and for studying the transport and behavior of heavy metal cations in the surface and sub-surface flow systems. The annexes consisted of 23 technical papers in which were found the experimental results and interpretations on which the summary statements in the three chapters were based. The report was contained in two volumes. (Sims-ISWS) W78-07406

DISTRIBUTION OF PHOSPHORUS AND MYRIOPHYLLUM IN HAMPSHIRE New Hampshire and Plant Pat. For primary 1 W78-07482

DYNAMICS T. I. Malinina Rumyantsev Soviet Hydro 3, p 199-202 from Trudy S'yedza, Vol

Descriptors: tutions, Dy vestigations, processing, rents(Water) Seasonal, \*USSR.

Using N.A. nomograms of wind spe Lake Onega only in the ing them is parison of t tained from ders. The ex of the US 'Valday' lev The formul Davydov we seiches. The titudinal sei to 4 hr 40 m 2 hr 09 min with a large dividual bay puted. Anal that seiches served in L period of 4 titudinal. It and south sh min is obser probably a with a peri Seiches wit in various b seiches is l ceases to vezh'yegors W78-07501

COMPUTA RENTS IN RESERVOIR For primary W78-07502

U.S. IFYGI ARCHIVE National O tion, Wash vice. R. E. Denni NOAA Tec 67 p, 9 fig, 4

Descriptors \*Water res storage a Meteorolog Field Year 4

This report U.S. ships during the



## WATER CYCLE—Field 2

### Water In Plants—Group 21

#### DISTRIBUTION, GROWTH, AND PHOSPHORUS RELATIONSHIPS OF MYRIOPHYLLUM HETEROPHYLLUM MICHX. IN LAKE WINNIPESAUKEE, NEW HAMPSHIRE.

New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.

For primary bibliographic entry see Field 5C.  
W78-07482

#### DYNAMICS OF LAKE ONEGA WATERS,

T. I. Malinina, A. N. Okhlopova, and V. B. Rummyantsev.

Soviet Hydrology: Selected Papers, Vol. 15, No. 3, p 199-202, 1976. 4 fig, 1 tab, 5 ref. Translated from Trudy IV Vsesoyuznogo Gidrologicheskogo S'yezda, Vol. 5, p 213-222, 1975.

Descriptors: \*Lakes, \*Seiches, \*Water level fluctuations, Dynamics, Model studies, On-site investigations, On-site data collections, Data processing, Winds, Tides, Wind tides, Currents(Water), Density, Density currents, Seasonal, Limnology, \*Lake Onega(USSR), \*USSR.

Using N.A. Labzovskiy's method of computation, nomograms of tidal level fluctuations as a function of wind speed and directing were obtained for Lake Onega. Seiches are observed almost continuously in the lake. The main method for investigating them is by theoretical computation and comparison of the results with observational data obtained from an analysis of the tapes of level recorders. The expeditions of the Limnological Institute of the USSR Academy of Sciences installed 'Valday' level recorders in 15 different lake areas. The formulas of Merian, Dubois, Defant, and Davydov were used to compute the periods of the seiches. The computed period of a single-node longitudinal seiche of the lake varies from 4 hr 22 min to 4 hr 40 min and that of a two-node seiche, from 2 hr 09 min to 2 hr 20 min. The periods of seiches with a large number of nodes and seiches in individual bays and inlets of the lake also were computed. Analysis of the level recorder tapes showed that seiches with nine different periods are observed in Lake Onega. A seiche with an average period of 4 hr 20 min has a single node and is longitudinal. It is most distinct at posts on the north and south shores. A seiche with a period of 2 hr 15 min is observed in the central part of the lake; it is probably a two-node longitudinal seiche. A seiche with a period of 65 min is observed frequently. Seiches with a period from 13 hr to 8-6 min occur in various bays and inlets. The amplitude of the seiches is low, as a rule, about 8-10 cm, but increases to 18-22 cm in the region of Medvezh'yegorsk city. (Sims-ISWS)  
W78-07501

#### COMPUTATION OF THE PATTERN OF CURRENTS IN RIVERS AND NONSTRATIFIED RESERVOIRS.

For primary bibliographic entry see Field 2F.  
W78-07502

#### U.S. IFYGL SHIP SYSTEM: DESCRIPTION OF ARCHIVED DATA.

National Oceanic and Atmospheric Administration, Washington, DC. Environmental Data Service.

R. E. Dennis.  
NOAA Technical Report EDS 27, January 1978. 67 p, 9 fig, 4 tab, append.

Descriptors: \*Lake Ontario, \*Data collections, \*Water resources, \*Hydrologic aspects, Data storage and retrieval, Hydrologic data, Meteorological data, Weather data, International Field Year for the Great Lakes(IFYGL).

This report describes the data collected aboard the U.S. ships RESEARCHER and ADVANCE II during the International Field Year for the Great

Lakes (IFYGL), a joint United States-Canadian program conducted in 1972-73 for the study of Lake Ontario and its basin. Sensors, data acquisition systems, and data processing procedures are discussed, and inventories are given of the archived data. (NOAA)  
W78-07554

#### A FIVE-YEAR MONITORING STUDY OF THE CHLORINATED HYDROCARBONS IN THE FISH OF A FINNISH LAKE ECOSYSTEM,

Jyvaskyla Univ. (Finland).

For primary bibliographic entry see Field 5A.  
W78-07667

#### SEDIMENT THICKNESSES, EASTERN LAKE CHAMPLAIN,

Vermont Univ., Burlington. Dept. of Geology.

For primary bibliographic entry see Field 2J.  
W78-07686

## 21. Water In Plants

#### DELINEATION OF TIDAL WETLANDS BOUNDARIES IN LOWER CHESAPEAKE BAY AND ITS TRIBUTARIES,

Virginia Inst. of Marine Science, Gloucester Point.

For primary bibliographic entry see Field 2L.  
W78-07229

#### SHORELINE PLANT ESTABLISHMENT AND USE OF A WAVE-STILLING DEVICE,

Texas A and M Univ., College Station.

For primary bibliographic entry see Field 2L.  
W78-07230

#### TAXONOMIC STUDIES ON AQUATIC HYPHOMYCETES, I. LEMONNIERA DE WILDEMAN,

Exeter Univ., (England). Dept. of Biological Sciences.

For primary bibliographic entry see Field 5A.  
W78-07271

#### EVOLUTIONARY STUDIES ON THE SHAPE OF THE CELL AND OF THE CHLOROPLAST IN DESMIDS,

Lund Univ. (Sweden). Limnological Inst.

E. Teiling.  
Botaniska Notiser, 1952, No 3, p 264-306. 31 fig, 68 ref.

Descriptors: \*Desmids, \*Evolution, \*Cytological studies, \*Chloroplasts, \*Phytoplankton, Algae, Light, Classification, Speciation, Chlorophyll, Photosynthesis, Ecology.

The role of light-ecological agents in the phylogeny of the desmid chloroplast, as well as the connecting causative formation of the shape of the desmid cell are discussed. Compressed (biradial) desmids appear to be descended from angular (pluriradial) desmids, with these descended in turn from short, circular ancestors. This evolution, in the author's view, was induced by light. The vast majority of desmids are characterized by a radiate chloroplast, which is not always readily visible. It has previously been shown how the chloroplast, which is not always readily visible. It has previously been shown how the chloroplast of the angulo-radiate (compressed and angular) desmids, comprising the majority of the placoderms, probably arose from a primitive radiate chloroplast in ancestral desmids. The radial enlargement of the radiate lamellae of the chloroplast favored greater photosynthesis. In corresponding change in the cell wall, the short cylindrical shape evolved into an angular one, each angle containing the outgrown distal part of a chloroplast lamella. Quadriradial, triradial, and biradial forms evolved. The latter represent the end stage, characteristic of the majority of

placoderm desmids (Cosmarium, Euastrum, Micrasterias, etc.). The trend toward reduction, a further light-related selection, gives chlorophyll better exposure to light. A historical survey, review of terminology, and taxonomic descriptions accompany the analysis. (Lynch-Wisconsin)  
W78-07283

#### MORPHOLOGICAL INVESTIGATIONS OF ASYMMETRY IN DESMIDS,

Lund Univ. (Sweden) Limnological Inst.

E. Teiling.

Botaniska Notiser, 1957, Vol 110, No 1, p 49-82. 39 fig, 111 ref.

Descriptors: \*Desmids, \*Plant morphology, \*Phytoplankton, \*Asymmetry, \*Algae, Symmetry, Biradial symmetry, Omniradial symmetry.

The symmetry of desmids as a group and asymmetrical features of certain desmid genera are examined and terminology and definitions are proposed. Traditional and modern interpretations of the radiating structure of desmids were considered in formulating a system and terminology for desmid symmetry. The framework consists of (1) a vertical axis, (2) an isthmal plane perpendicular to the vertical axis and penetrated by it in an origin, (3) radial axes going out from this origin, and (4) radial planes determined by the vertical and radial axes. The junction of the two semicells is situated in the isthmal plane. As biradial desmids are the most abundant, terminology is geared to them. In these desmids, the two radial and interradial planes each form symmetrical planes. In round (omniradial and pseudo-omniradial) desmids there is an infinite number of radial planes. Available asymmetrical material, although limited, is sufficient to establish some conclusions. The majority of Closterium, Nothocosmarium, Oocardium, and Phymatodocis irregular must be considered constant asymmetrical taxa. Semiradial asymmetry is recorded in many species of quite different genera: Cosmarium, Staurostrum, Staurodesmus, Euastrum, Micrasterias, Spondylosium, Streptocoma, Phymatodocis, Xanthidium, and Sphaeroszoma. Omniradial and pseudo-omniradial desmids are excluded from this kind of asymmetry. (Lynch-Wisconsin)  
W78-07284

#### ANTECEDENT EVENT INFLUENCE ON BENTHIC MARINE ALGAL STANDING CROPS IN HAWAII,

Hawaii Univ., Honolulu. Dept. of Botany.

For primary bibliographic entry see Field 2L.

W78-07295

#### PRODUCTIVITY OF RED-WINGED BLACKBIRDS IN PRAIRIE POTHOLE HABITAT.

Fish and Wildlife Service, Jamestown, ND. Northern Prairie Wildlife Research Center.

G. L. Krapu.

Iowa Bird Life, XLVIII, 1978. 7 p, 4 tab, 22 ref.

Descriptors: \*Song birds, \*Wildlife habitats, \*Productivity, \*Freshwater marshes, Wildlife, Non-game birds, Birds, Nesting, Broods, Predation, Marshes, Wetlands, \*Iowa, Grasslands, \*Potholes, \*Red-winged Blackbirds, Nest success.

Productivity of the Red-winged Blackbird was studied at six marsh and three upland sites on a 200-ha game management area in northwest Iowa. Nest success, egg hatching, and fledging rates averaged 4 percent, 25 percent, and 3 percent on uplands and 30 percent, 47 percent, and 24 percent in marshes, respectively. Poor reproductive success in upland habitat resulted when nesting was terminated in mid-June following an initial failure. Cowbirds parasitized 29 percent of the upland nests and 2 percent of the marsh nests. Fledging rates in the deep marsh zone of semi-permanent

### Group 21—Water In Plants

**PLANT SPECIES DIVERSITY IN A MARINE INTERTIDAL COMMUNITY: IMPORTANCE OF HERBIVORE FOOD PREFERENCE AND ALGAL COMPETITIVE ABILITIES,**  
Harvard Univ., Cambridge, MA. Biological Lab.  
For primary bibliographic entry see Field 21.  
W78-07341

**A STUDY OF DIFFERENT ANALYTICAL EXTRACTION METHODS FOR NONDETRITAL HEAVY METALS IN AQUATIC SEDIMENTS,**  
Canada Centre for Inland Waters, Burlington  
(Ontario).  
For primary bibliographic entry see Field 5A.  
W78-07278

**LINSE: A ONE DIMENSIONAL MULTIREACH SEDIMENT TRANSPORT MODEL,**  
Oak Ridge National Lab., TN. Computer Sciences Division.  
D. E. Fields.  
Available from the National Technical Information Service, Springfield, VA 22161 as ORNL/CSD-15 Price codes: A06 in paper copy, A01 in microfiche. Report No. ORNL/CSD-15, October 1976. 93 p, 5 fig, 4 tab, 10 ref, 7 append. NCR 60190501.

SEDTRN, a model of sediment transport for a rectangular stream channel, has been combined with a driver code to allow simulation of sediment transport in a one dimensional, multi-reach channel system. This model, LINEDS, was dimensioned to accept specification of a branching channel system of up to nine nominally homogeneous reaches. Sediment input to each reach from external sources along the reach was allowed. This approach to steady-state sediment transport is an extension of that described by R.A. Begnold (1966), but included Manning's equations to determine flow rate and modifications to Stokes' law allowing calculation of particulate fall velocity in both the viscous and inertial particle settling regions. Sediment is separated conceptually into three components: resident sediment in the stream bed, sediment in transit as bedload, and sediment in transit as suspended load. Each of these components was partitioned into as many as 12 size classes of logarithmically varying size ranges. A comparison of LINEDS simulation results to observed sediment transport rates for the Rio Grande River was included. (Bhowmik-ISWS)

W78-07363

**FLOODING IN BIG THOMPSON RIVER, COLORADO, TRIBUTARIES: CONTROLS ON CHANNEL EROSION AND ESTIMATES OF RECURRENCE INTERVAL,**  
Colorado Univ., Boulder. Dept. of Geography; and Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.  
For primary bibliographic entry see Field 4D.  
W78-07371

**Descriptors:** \*Ephemeral streams, \*Stream erosion, \*Alluvial channels, \*California, Scour, Aggradation, On-site investigations, Laboratory tests, Testing procedures, Streams, Floods, Streambeds, Hydraulics, Discharge(Water), River beds, Erosion, \*Quatal Creek(Calif).

**COMPOSITION OF SUSPENSIONS AND SEDIMENTS IN THE ESTUARIES OF THE NORTHERN DVINA, MEZEN', PECHORA, AND OB' RIVERS,**  
For primary bibliographic entry see Field 2L.  
W78-07405

**PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF NEARSHORE ZONE OF SAND KEY, FLORIDA, PRIOR TO BEACH RESTORATION. VOL. 1.**  
National Marine Fisheries Service, Panama City, FL. Gulf Coastal Fisheries Center.  
C. H. Saloman.  
NOAA, National Marine Fisheries Service, Interservice Report to U.S. Army Corps of Engineers, June 1974. 587 p. Interservice Agreement CFRC 73-27.

The purpose is to define some of the major physical, chemical, and biological characteristics of the nearshore zone off Sand Key prior to restoration. Also included are results of a supplemental study on the effects of hydraulic dredging for emergency restoration of Sunset Beach on Treasure Island, Florida, and an extensive bibliography of published and unpublished information pertinent to the physical, chemical, and biological characteristics of the nearshore zone. (See also W78-02180) (NOAA)  
W78-07407

**Descriptors:** \*Bed load, \*Channels, \*Rivers, Dredging, Dunes, Erosion, Sedimentation, Slopes, Slope stability, Navigation, Hydraulics, Navigable rivers, \*Navigation channels, Side slopes, Particle path, Bed shear.

**A SIMPLE LABORATORY APPARATUS TO MEASURE RELATIVE ERODIBILITY OF SOILS,**  
Allahabad Univ. (India).  
S. Chandra, and S. K. De.  
Soil Science, Vol. 125, No. 2, p 115-121, February 1978. 3 fig. 3 tab. 18 ref.

A simple laboratory apparatus designed for rapid and inexpensive measurement of the relative erodibility of soils was described. Erosion coefficients obtained with this apparatus were correlated with other erosion indices, viz., erosion ratio, clay ratio, and silica:sesquioxide ratio, and were found to be in good agreement. This apparatus can be used where routine analysis is required of a large number of soil samples for their relative erodibility by water. (Lee-ISWS) W78-07504

**SUSPENDED-MATTER DISTRIBUTION IN THE  
NEW YORK BIGHT APX RELATED TO HUR-  
RICANE BELE,**  
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Atmospheric Labs.; and National Oceanic and Atmospheric Administration, Miami, FL. Marine Geology and Geophysics Lab.  
For primary bibliographic entry see Field 2L.  
W78-07509

**ENVIRONMENTAL CONSIDERATIONS  
RELATING TO OPERATION AND MAINTENANCE  
OF THE TEXAS GULF INTRACOASTAL WATERWAY,**  
Texas A and M Univ., College Station. Ocean Engineering Program.  
For primary bibliographic entry see Field 2L.  
W78-07538

**USE OF BENEFITORS OF MA**  
Oregon State U  
gineering.  
For primary bil  
W78-07553

**SEDIMENT TOXICITY TO FISH IN THE CHAMPLAIN RIVER**  
Vermont Univ. of Water Resour.  
A. S. Hunt.  
Available from NTIS Document  
NTIS Service, Springfield, MA  
A03 in paper copy form.  
Report Vermont Water Resour.  
Center, Burlington, VT 05405.  
plates, 47 refs.  
7096

Descriptors: plain, \*Sedimentation rates, \*Vermeil basins, Geology

A sub-bottom  
been complet  
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W78-07686

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**RELATIONS  
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**Descriptors**  
Bacteria, *Salmonella*  
\*Saline water  
Energy production  
Sampling, water  
analysis. Potable

Seventy facies were sampled. The major facies are limestone and dolomite. The standard model is that the dolomite, a



**THE 1973 BATHYMETRIC SURVEY IN THE NEW YORK BIGHT APEX: MAPS AND GEOLOGICAL IMPLICATIONS.**  
 National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.  
 For primary bibliographic entry see Field 2L.  
 W78-07548

**USE OF BENTHIC SEDIMENTS AS INDICATORS OF MARINA FLUSHING.**  
 Oregon State Univ., Corvallis. Dept. of Ocean Engineering.  
 For primary bibliographic entry see Field 5A.  
 W78-07553

**SEDIMENT THICKNESSES, EASTERN LAKE CHAMPLAIN.**  
 Vermont Univ., Burlington. Dept. of Geology. A. S. Hunt.  
 Available from the National Technical Information Service, Springfield, VA 22161. Price codes: A03 in paper copy, A01 in microfiche. Completion Report Vermont Water Resources Research Center, Burlington, September 1977. 31 p., 1 fig., 4 plates, 47 ref. OWRT A-027-VT(1), 14-34-0001-7096.

Descriptors: Sub-bottom profiling, \*Lake Champlain, \*Sediment thicknesses, Sedimentation rates, \*Vermont, Lakes, \*Lake sediments, Lake basins, Geologic time, Post-glacial time.

A sub-bottom profiling study using an air gun has been completed for central, northern and eastern Lake Champlain giving sediment thicknesses and bedrock topography of the Lake basin. Four major depositional basins have been recognized in the central Lake. The deepest has a maximum depth of 1100 feet and a sediment thickness of 700 feet. The variable bedrock relief is attributed to faulting, variations in bedrock lithology, and glacial scour. Bedrock basin relief in northern and eastern Lake Champlain is less variable than in the central Lake and sediment thicknesses are not as great (maximum 300 feet). Major areas of sedimentation within the Lake are river deltas and deep basins. Sediment thickness in the basins is more closely related to the topographic configuration of the bedrock basin than to distance from shore or proximity to sediment source. Maximum sedimentation rates occurred in central Lake Champlain during early post-glacial time.  
 W78-07686

## 2K. Chemical Processes

**RELATIONSHIP BETWEEN GROUNDWATER RESOURCES AND ENERGY PRODUCTION IN SOUTHWESTERN MISSOURI.**  
 Missouri Univ., Columbia. Dept. of Geology. A. B. Carpenter, and J. M. Darr.  
 Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 583. Price codes: A06 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, Rolla, Completion Report, April 1978. 113 p., 28 fig., 17 tab, 60 ref. OWRT A-086-MO(1), 14-34-0001-6026, 7053 and 7054.

Descriptors: Calcite, Dolomite, Clay minerals, Bacteria, Sulfate reduction, Methanogenesis, \*Saline water intrusion, \*Groundwater resource, Energy production, \*Water wells, Water supply, Sampling, \*Missouri, Water chemistry, Water analysis, Pollutant identification.

Seventy farm and municipal water-supply wells were sampled in Bates, Barton, and Vernon counties. The mineralogy of Pennsylvanian sandstones and limestones in the area were determined by standard methods. Analysis of the data indicates that the water is in equilibrium with calcite, dolomite, quartz, illite, potash feldspar, and albite.

The water is not in equilibrium with kaolinite. The relationships between dissolved sulfur, carbon, iron, pH, and pE indicate that the ground water is not in redox equilibrium. The pronounced fractionation of C12 between methane and associated bicarbonate in the water indicates that the methane is of biogenic origin. The rate and pattern of salt water intrusion in the area have been determined. The movement of selected isochlors between 1966 and 1975 indicates that saline water is migrating in from the northwest and moving in an east-southeastward direction. The intrusion of brackish water is probably occurring in response to regionally reduced water levels created by the withdrawal of ground water. The rate of salt water intrusion and the size of the affected area are likely to increase if utilization of ground water for farming and industry continues to rise.  
 W78-07202

**DETERMINATION OF TRACE ELEMENTS IN THE ENGLISH COULEE SYSTEM: PRESENCE DUE TO EXTENDED LIGNITE BURNING.**  
 North Dakota Univ., Grand Forks. Dept. of Physics.  
 For primary bibliographic entry see Field 5A.  
 W78-07208

**A NEW DIALYSIS-ION EXCHANGE TECHNIQUE FOR DETERMINING THE FORMS OF TRACE METALS IN WATER.**  
 Caulfield Inst. of Tech. Victoria (Australia). Water Studies Centre.  
 For primary bibliographic entry see Field 5A.  
 W78-07277

**A STUDY OF DIFFERENT ANALYTICAL EXTRACTION METHODS FOR NONDETRITAL HEAVY METALS IN AQUATIC SEDIMENTS.**  
 Canada Centre for Inland Waters, Burlington (Ontario).  
 For primary bibliographic entry see Field 5A.  
 W78-07278

**SALINITY: ITS DEFINITION AND CALCULATION.**  
 Department of the Environment, Victoria British (Columbia). Frozen Sea Research Group. E. L. Lewis, and R. G. Perkin.  
 Journal of Geophysical Research, Vol. 83, No. C1, p 466-478, January 20, 1978. 3 fig., 8 tab, 60 ref.

Descriptors: \*Salinity, \*Measurement, \*Oceans, Electrical conductance, Temperature, Water temperature, Pressure, Depth, Instrumentation, Data processing, Analytical techniques, Ions, Density, Chemical analysis, Oceanography.

Salinity data used to trace water movement or compute density normally are derived from measurements of chlorinity or electrical conductivity, temperature, and pressure. The latter technique has a precision about 1 order magnitude greater than that of a typical chlorinity titration, but both are sensitive in different ways to variations in the ionic ratios of seawater. Present definitions of salinity are also ion dependent, causing significant variations in the salinity-density relationship which cannot be simply expressed. In order to obtain density to an accuracy commensurate with the available precision, it is best to define salinity in relation to a water mass of known ionic content so that a density correction to be applied to other water masses may be expressed as variations from a fixed standard. These corrections then appear in the form of simple additive constants for most waters; and where density differences are the important parameter, correction is necessary within a specific water mass. The new salinity definition is based on dilution by weight of a conductivity ratio labeled standard seawater. It would be invariant under compositional variations and in accord with the proposed new equation of state. It is conservative within acceptable limits, would provide a

'practical salinity scale' for use by oceanographers of all levels of sophistication, and would facilitate greatly data comparisons between institutions. The present variety of computational procedures for in situ data reduction would be replaced by one set of definitive equations that would not be subject to change as the precision of physical or chemical measurement improved. A great part of the data base necessary to write these equations exists, and the remainder should be available by 1978. (Sims-ISWS)  
 W78-07367

**PH AVERAGING.**  
 State Univ. of New York at Buffalo. Dept. of Civil Engineering.  
 For primary bibliographic entry see Field 5A.  
 W78-07456

**THE BACKGROUND TO, AND THE APPLICATION OF, LABORATORY INSTRUMENTATION TO WATER ANALYSIS.**  
 Pye Unicam Ltd., Cambridge (England) ACUV Applications Labs.  
 For primary bibliographic entry see Field 5A.  
 W78-07458

**EFFECTS OF CLAY TYPE AND CONTENT, EXCHANGEABLE SODIUM PERCENTAGE, AND ELECTROLYTE CONCENTRATION ON CLAY DISPERSION AND SOIL HYDRAULIC CONDUCTIVITY.**  
 Agricultural Research Service, Riverside, CA. Salinity Lab.  
 For primary bibliographic entry see Field 2G.  
 W78-07498

**NONPOINT NITRATE CONTAMINATION OF GROUND WATER IN MERRICK COUNTY, NEBRASKA.**  
 Nebraska Univ., Lincoln. Div. of Natural Resources, Conservation and Survey.  
 For primary bibliographic entry see Field 5B.  
 W78-07506

**SAMPLING OF WATER AND WASTEWATER.**  
 EG and G Washington Analytical Services Center, Inc., Rockville, MD.  
 For primary bibliographic entry see Field 5A.  
 W78-07517

**THE RESULTS OF FOUR OCEANOGRAPHIC CRUISES IN THE GEORGIA BIGHT.**  
 Skidaway Inst. of Oceanography, Savannah, GA.  
 For primary bibliographic entry see Field 2L.  
 W78-07537

**A CORING AND SQUEEZING TECHNIQUE FOR THE DETAILED STUDY OF SUBSURFACE WATER CHEMISTRY.**  
 Queen's Univ., Kingston (Ontario). Dept. of Geological Sciences. R. J. Patterson, S. K. Frap, L. S. Dykes, and R. A. McLeod.

Descriptors: \*Cores, \*Sampling, \*Water analysis, Geochemistry, Sediments, Capillary water, Groundwater, Piston core samplers, Core squeezing, Equipment.

A coring and squeezing technique has been developed to permit collection of closely spaced samples of pore water, which is applicable to both saturated and unsaturated zones on land. Coring is done with an extensively modified Livingston piston sampler; thin wall aluminum tubing makes up the barrel, and special drive head adaptors make penetration of resistant sediments possible by either manual or mechanical means. Water samples are obtained by placing short sections of sediment from fresh cores in a mechanical

## Field 2—WATER CYCLE

### Group 2K—Chemical Processes

squeezer. In certain cases where the high pressures necessary to extrude the cores would result in pore water migration, the core barrel can be cut into short lengths prior to extrusion, an economically justifiable technique considering the relatively low cost of the thin-walled aluminum. If coarse incompressible sediments are encountered, pore water can be removed by an immiscible-fluid displacement technique in lieu of mechanical squeezing. Water samples can then be analyzed by standard methods for major and minor components. (Eberle-NWWA)  
W78-07575

#### WATER WELL SAMPLES MUST BE COLLECTED WITH CARE.

For primary bibliographic entry see Field 5A.  
W78-07584

### 2L. Estuaries

**WATER-COLUMN AND BENTHIC INVERTEBRATE AND PLANT ASSOCIATIONS AS AFFECTED BY THE PHYSICO-CHEMICAL ASPECTS IN A MESOTROPHIC BAYOU ESTUARY PENSACOLA, FLORIDA.**  
University of West Florida, Pensacola. Water Resources Research Center.  
For primary bibliographic entry see Field 5C.  
W78-07203

**THE IMPACT OF THE 1975 BONNET CARRE SPILLWAY OPENING ON EPIFAUNAL INVERTEBRATES IN SOUTHERN LAKE PONTCHARTRAIN.**  
New Orleans Univ., LA. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W78-07219

**CITY OF NEWPORT NEWS AND FORT EUSTIS TIDAL MARSH INVENTORY.**  
Virginia Inst. of Marine Science, Gloucester Point.  
K. A. Moore.  
Special Report No. 137 in Applied Marine Science and Ocean Engineering, April, 1977. 60 p.

Descriptors: \*Coastal marshes, \*Virginia, \*Census, \*Marsh management, Wetlands, Marshes, Tidal marshes, Salt marshes, Marsh plants, Halophytes, Aquatic plants, Mapping, Newport News(Virginia), Fort Eustis(Virginia), Warwick River(Virginia).

Wetlands within the City of Newport News and the Fort Eustis Military Reservation total 2883 acres. Of this, approximately 70% or 2029 acres are located within the boundaries of Fort Eustis, while the remaining 30% or 854 acres are in Newport News. The majority of marshes are dominated by salt tolerant plants. These include such species as saltmarsh cordgrass, saltmeadow grasses, black needlerush, saltbrushes, and big cordgrass. Freshwater marsh species are found only at the heads of tidal creeks. The report is organized into seven sections each of which describes a length of shoreline. Section I covers the vicinity of Skiffes Creek and Goose Island. Sections II and III include Mulberry Island and Fort Eustis. The Warwick River shoreline and its tributaries are described in sections III, IV, V, and VI. Section VII describes the Newport News section south of the Warwick River. (Steiner-Mass)  
W78-07224

**TIDAL MARSH BIBLIOGRAPHY, SELECTED KEY WORK INDEX (PARTIALLY ANNOTATED).**  
Delaware Univ., Newark. Coll. of Marine Studies.  
F. C. Daiber.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 386. Price codes: A13 in paper copy, A01 in microfiche. Sea Grant Technical Report No. Del-SG-21-76. 1976. 281 p.

Descriptors: \*Tidal marshes, \*Coastal marshes, \*Bibliographies, Pollution, Productivity, Aquatic plants, Aquatic animals, Ecology, Marsh management.

References on many aspects of tidal marshes are listed including: formation and distribution, plant and animal communities, chemical and physical parameters, impact of land use activities, nutrients, pollutants, productivity, management, remote sensing, and legislation. The bibliography is arranged first as a key word index, then alphabetically by author. Many articles are cross-referenced. (Stihler-Mass)  
W78-07226

#### DELINEATION OF TIDAL WETLANDS BOUNDARIES IN LOWER CHESAPEAKE BAY AND ITS TRIBUTARIES.

Virginia Inst. of Marine Science, Gloucester Point.  
J. D. Boon, III, M. E. Boule, and G. M. Silberhorn.  
Special Report No. 140. In: Applied Marine Science and Ocean Engineering, March, 1977. 127 p, 16 fig, 4 tab, 28 ref, append.

Descriptors: \*Tidal marshes, \*High water mark, \*Boundaries(Property), \*Wetlands, Coastal marshes, Salt marshes, Marshes, Marsh plants, Earth-water interfaces, Sea water, Tides, Water levels, Tidal waters, Virginia, Classification, \*Chesapeake Bay, Freshwater marshes.

Ways of delineating the boundary between tidal marshes and adjacent uplands were investigated in both saline and freshwater systems. Consistent elevational differences were determined between the upper limit of tidal marshes (ULM) and the tidal datum of mean high water (MHW) at 13 survey sites. The ULM-MHW differences fell into two groups-differentiating saline and freshwater tidal marshes. For the saline marshes, the group average for the ULM elevation was 0.95 feet above MHW; for the freshwater marshes, the average ULM elevation was 0.59 feet above MHW. The distinction between the two marsh types is supported by statistical confidence limits on the ULM-MHW difference. Analyses of 20-year tide records show that ULM elevation designated for saline marshes will be exceeded by approximately 10% of the high tides occurring in an average year. The freshwater ULM elevation will be exceeded by approximately 20% of the high tides. In broad, shallow embayments and coastal sounds having restricted tidal communication with the sea, the ULM elevation may stand 0.3-0.5 feet higher in relation to MHW than normal. (Steiner-Mass)  
W78-07229

#### SHORELINE PLANT ESTABLISHMENT AND USE OF A WAVE-STILLING DEVICE.

Texas A and M Univ., College Station.  
J. W. Webb, and J. D. Dodd.  
Miscellaneous Report No. 78-1, U. S. Army, Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Virginia, January, 1978. 28 p, 8 fig, 7 tab, 14 ref.

Descriptors: \*Marsh plants, \*Planting management, \*Environmental effects, \*Vegetation establishment, \*Waves(Water), Wetlands, Marshes, Coastal marshes, Tidal marshes, Salt marshes, Grasses, Aquatic plants, Rooted aquatic plants, Halophytes, Plant growth, Texas, \*Spartina alterniflora, East Bay(Texas).

Survival and tiller production of *Spartina alterniflora* occurred within the tidal zone behind a wave-stilling device constructed of two tiers of tires strung on a cable. A 0.5 m buildup of sedi-

ment occurred directly behind the barrier. *S. alterniflora* survival was approximately 50% and over 100 stems/sq m were counted in some areas one year after planting. Density and height of *S. alterniflora* increased with increasing hours of inundation. Rabbits caused enough damage to plants outside a rabbit-proof fence that significant differences in density occurred. *Spartina spartinae*, *Spartina patens*, and *Distichlis spicata* survived better than *S. alterniflora* above mean high water (MHW). At the highest elevation (0.6 m above MHW), survival was limited, regardless of species. *Juncus roemerianus* transplants failed to survive in significant numbers. (Steiner-Mass)  
W78-07230

**IBM 1130 COMPUTATION PROCESS IN THE STUDY OF BIOPHYSICAL CONSTANTS VARIATIONS OF PATHOGENOUS BACTERIA BY PHYTOPLANKTON.**  
Santiago Univ. (Spain). Dept. of Microbiology.  
For primary bibliographic entry see Field 5C.  
W78-07264

**PHOTORESPIRATION IN LARGER LITTORAL ALGAE.**  
Exter Univ. (England). Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W78-07274

**ANNUAL FLUCTUATIONS IN BIOMASS OF TAXOMIC GROUPS OF ZOOPLANKTON IN THE CALIFORNIA CURRENT.**  
Institute for Marine Environmental Research, Plymouth (England).  
For primary bibliographic entry see Field 5C.  
W78-07275

**FRESHWATER RESOURCES OF THE OREGON COASTAL ZONES.**  
Oregon Water Resources Board, Salem.  
Natural Resources Inventory Report to Oregon Coastal Conservation and Development Commission, Salem, December 1974, 76 p, 22 fig, 13 tab, 31 ref.

Descriptors: \*Baseline studies, \*Oregon, \*Water resources, \*Coasts, Freshwater, Rivers, River basins, Watersheds(Basins), Streams, Precipitation(Atmospheric), Reservoir, Lakes, Flooding, Water uses, Water management(Applied), Water policy, Water supply.

Oregon coastal zone water use, water needs, management aspects (policy, water availability, reservoir potential, and water supply potential), and flooding considerations are inventoried. The zone is divided into the North Coast Basin (Columbia River to Neskonwinn Creek), Mid-Coast Basin (Salmon River to Tahkenitch Creek), and South Coast Basin (Tenmile Creek to the Oregon-California border). The humid North Coast Basin receives 70-150 in. of precipitation annually. Most rivers are less than 30 miles in length. The Mid-Coast Basin is drained by six major river systems, and about 70 smaller watersheds. Rainfall in this temperature, humid climate varies from 60-200 in., with 80% occurring between October and March. The South Coast Basin includes four major stream systems, and receives 50-120 in. of rainfall annually. Municipalities and industries are the primary water consumers throughout the coastal zone; irrigation is an important use in some areas. Major nonconsumption uses are fish life, recreation, and navigation. Water use conflicts have plagued the coastal zone. Reservoir storage is the only feasible means of augmenting the low summer flows. Most of the major streams have flooding problems, particularly in the Tillamook Bay area, lower Siuslaw River, and Coquille valley. Water storage projects should include flood control among their functions. (Lynch-Wisconsin).  
W78-07281

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IN HAWAII,  
Hawaii Univ.,  
M. S. Doty.  
Available from  
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Price codes: A  
Journal of  
Ecology, Vol

Descriptors:  
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# ANTHROPIC EVENT INFLUENCE ON BENTHIC MARINE ALGAL STANDING CROPS IN HAWAII

Hawaii Univ., Honolulu. Dept. of Botany. M. S. Doty.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 386. Price codes: A02 in paper copy, A01 in microfiche. Journal of Experimental Marine Biology and Ecology, Vol. 6, 1971, p 161-166. 3 fig, 4 ref.

Descriptors: \*Marine algae, \*Standing crops, Waves(Water), \*Light, \*Water temperature, \*Hawaii, Honolulu(HI), Reefs, Algae, Seasonal, Storms, Plant growth, Weight, Pacific Ocean, Oceans.

A study of factors influencing the size of the harvestable frondose marine algal crop in a non-monsoonal tropical area (Hawaii) concludes that random effects of storm waves may be more important than seasonal effects of light and water temperature. Algal standing crops on a reef flat at Waikiki, Honolulu, Hawaii were measured seven times December 1966-April 1968. Results were calculated in mean weight/sq m of reef surface. Correlation and regression values were calculated for crop size against three environmental factors (light, wave size, and water temperature) separately for each of the six previous weeks and for the week of the harvest. The wet standing crop averaged 2.3 kg/sq m, varying from 1.3-3.1 kg/sq m. With increasing time prior to measurement of standing crop, the influence of light steadily decreased, that of storm waves increased to within three weeks before the sampling period, then decreased, and the effect of water temperature increased consistently. Little seasonality was apparent in total standing crop, although seasonal variation existed in light energy and temperature. Light is probably the factor primarily responsible for producing dry weight; the other two factors acting to reduce the dry matter must act secondarily and thus further back in antecedent time. The inverse relationship between crop size and wave height is not surprising as storm waves destroy the standing crop. (Lynch-Wisconsin)  
W78-07295

**THE UTILIZATION OF DISSOLVED ORGANIC COMPOUNDS IN AQUATIC ENVIRONMENTS**, Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).  
For primary bibliographic entry see Field 5C.  
W78-07296

**MARINE POLLUTION HAZARDS**, Southern California Univ., Los Angeles. Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5C.  
W78-07297

**MACROBENTHOS OF THE TIDAL DELAWARE RIVER BETWEEN TRENTON AND BURLINGTON, NEW JERSEY**, Ichthyological Associates, Inc., Middletown, DE.  
For primary bibliographic entry see Field 5C.  
W78-07300

**THE IMPACT OF NITROGEN AND PHOSPHORUS RELEASE FROM A SILICEOUS SEDIMENT ON THE OVERLYING WATER**, Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.  
For primary bibliographic entry see Field 5C.  
W78-07302

**AN IN SITU STUDY OF RECRUITMENT, GROWTH AND SURVIVAL OF SUBTIDAL MARINE ALGAE: TECHNIQUES AND PRELIMINARY RESULTS**, California Univ., Santa Barbara. Dept. of Biological Sciences; and California Univ., Santa Barbara. Marine Science Inst.

For primary bibliographic entry see Field 5C.  
W78-07308

**PHOTORESPIRATION IN MARINE PHYTOPLANKTON**, Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.  
For primary bibliographic entry see Field 5C.  
W78-07309

**YORK COUNTY AND TOWN OF POQUOSSON TIDAL MARSH INVENTORY**, Virginia Inst. of Marine Science, Gloucester Point. Wetlands Research Section. G. M. Silberhorn.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 998. Price codes: A04 in paper copy, A01 in microfiche. Special Report in Applied Marine Science and Ocean Engineering No. 53, August, 1974. 71 p.

Descriptors: \*Census, \*Coastal marshes, \*Wetlands, Acreage, \*Virginia, Aerial photography, Mapping, Marshes, Marsh plants, Coasts, Biological communities, Earth-water interfaces, Distribution patterns, Coastal wetlands, York County(VA), Poquoson(VA).

This is the third publication in a series of marsh inventory reports for Virginia. Aerial photographs and topographic maps (U.S.G.S.) were consulted in order to obtain wetland locations and patterns of marsh vegetation. Marsh community zones and patterns were substantiated by ground truth methods, i.e., via boat and low-level flights. Acreages and wetland boundaries were obtained from these sources as well as from field estimates. Individual marsh acreage, plant community percentage and acreage, marsh type and other observations are recorded in tabular form. (See also W78-07311) (Steiner-Mass)  
W78-07310

**NORTHUMBERLAND COUNTY TIDAL MARSH INVENTORY**, Virginia Inst. of Marine Science, Gloucester Point. Wetlands Research Section. G. M. Silberhorn.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 999. Price codes: A06 in paper copy, A01 in microfiche. Special Report in Applied Science and Ocean Engineering No. 58, February, 1975. 101 p.

Descriptors: \*Census, \*Tidal marshes, \*Biogeography, \*Virginia, Wetlands, Marshes, Marsh plants, Costs, Biomass, Biological communities, Mapping, Spatial distribution, Acreage, \*Northumberland County(Virginia), Coastal zone management.

This publication is the fourth in a series of marsh inventory reports for Virginia. Aerial photographs and topographic maps (U.S.G.S.) were consulted in order to obtain wetland locations and patterns of marsh vegetation. Marsh community zones and patterns were substantiated by ground truth methods, including observations on foot, by boat, and by low-level overflights. Acreages and wetland boundaries are also estimated. Individual marsh acreage, plant community percentage and acreage, marsh type, and other observations are recorded in tabular form. (See also W78-07310) (Steiner-Mass)  
W78-07311

**SUMMARY REPORT - THE CHOWAN RIVER PROJECT**, North Carolina Water Resources Research Inst., Raleigh.  
For primary bibliographic entry see Field 5C.  
W78-07318

**POLLUTION IN THE NORTHEAST PACIFIC OCEAN**, National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.  
For primary bibliographic entry see Field 5B.  
W78-07325

**ECOLOGICAL COMPONENTS STRUCTURING THE SEAWARD EDGES OF TROPICAL PACIFIC REEFS: THE DISTRIBUTION, COMMUNITIES AND PRODUCTIVITY OF POROLITHON**, California Univ. Irvine. Dept. of Population and Environmental Biology. M. M. Littler, and M. S. Doty.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 325. Price codes: A02 in paper copy, A01 in microfiche. Journal of Ecology, Vol. 63, p 117-129. March 1975. 5 fig, 1 tab, 30 ref. AEC AT(04-3)-235; SG 2-35243.

Descriptors: \*Porolithon onkodes, \*Ecology, \*Biological communities, \*Reefs, \*Algae, Porolithon gardineri, Coral coasts, Hawaii, Waikiki(HI), Pacific Ocean, Oceans, Marine algae, Primary productivity, Waves(Water), Grazing, Lithophyllum kitschyanum.

Distribution of the tropical reef-building marine algae Porolithon was determined by photogrammetry during summer 1968 on a fringing reef at Waikiki, Hawaii, and biological interactions structuring seaward edges of the reef were investigated. Porolithon onkodes dominate the heavily grazed seaward slope of the algal ridge, covering 41% of the surface. Because of its role in maintaining and providing the surf-resistant reef edge, it is one of the most important reef-building organisms. P. onkodes is physiologically and physically adapted to withstand intense illumination, heavy surf and grazing. It requires continuous disturbance which prevents its competitive exclusion by frondose algae. Mean net contributions to total reef productivity were about 0.5 g C/sq m of fringing reef per day for P. onkodes, and 0.2 g C/sq m per day for P. gardineri. Net productivities of 2.2 g C/sq m of thallus per day for P. onkodes and 2.4 P. gardineri are within the range reported for other reef primary producers. On the crest portion of the algal ridges major species were P. gardineri (6% cover) and Lithophyllum kitschyanum (7% cover). The dominance of Porolithon on the ridge seems determined mainly by effects of wave force, grazing, and shading on competition among species. No evidence was seen that Porolithon or other coral-line crusts were inhibited by wave force. (Lynch-Wisconsin)  
W78-07327

**PLANT SPECIES DIVERSITY IN A MARINE INTERTIDAL COMMUNITY: IMPORTANCE OF HERBIVORE FOOD PREFERENCE AND ALGAL COMPETITIVE ABILITIES**, Harvard Univ., Cambridge, MA. Biological Lab. J. Lubchenco.  
The American Naturalist, Vol. 112, No. 983, p 23-39, January-February, 1978. 4 fig, 2 tab, 42 ref.

Descriptors: \*Intertidal areas, \*New England, \*Snails, \*Algae, \*Predation, Chlorophyta, Rhodophyta, Marine algae, Grazing, Competition, Distribution patterns, Ecological distribution, Dominant organisms, Food habits, Littorina littorea, Plant diversity, Food preference.

Field experiments demonstrate that the herbivorous marine snail, Littorina littorea, controls the abundance and type of algae in high intertidal tide pools in New England. Here the highest species diversity of algae occurs at intermediate Littorina densities. This unimodal relationship between algal species diversity and herbivore density occurs because the snails' preferred food is competitively dominant in tide pool habitats. Moderate grazing allows inferior algal species to



## Field 2—WATER CYCLE

### Group 21—Estuaries

persist and intense grazing eliminates most individuals and species. In contrast to pools, on emergent substrata where the preferred food is competitively inferior, this herbivore decreases algal diversity. Thus, the effect of this consumer on plant species diversity depends on the relationship between herbivore food preference, the competitive abilities of the plants, and on the intensity of the grazing or predation pressure. (Steiner-Mass)  
W78-07341

**A SIMPLE MODEL FOR CROSS-SHELF MIXING ON THE SCOTIAN SHELF,**  
Dalhousie Univ., Halifax. (Nova Scotia) Dept. of Oceanography.  
R. W. Houghton, P. C. Smith, and R. O. Fournier. *Journal of the Fisheries Research Board of Canada*, Vol 35, No 4, p 414-421, April 1978. 8 fig, 2 tab, 12 ref.

Descriptors: \*Canada, \*Model studies, \*Mixing, Salinity, Nitrate, Eddies, Oceanography, Ocean currents, Hydrology, Temperature, Foreign countries, Foreign research, \*Nova Scotia, Longshore gradients, Cross-shelf mixing, Water mass analysis, Eddy fluxes.

The longshore gradients of temperature, salinity, and nitrate concentration along the Scotian Shelf, and their fluxes at a fixed mooring south of Halifax, were measured separately. Water-mass analysis indicated that the water at the eastern end of the shelf is diluted with slope water by 40% at Halifax as a result of cross-shelf mixing. Recent estimates of the annual mean transport along the shelf were used to infer the longshore gradients supported by the shelf-break fluxes in the context of a simple box model. The observed longshore gradients of temperature, salinity, and nitrate concentration are consistent with productivity requirements and measured low frequency eddy fluxes at the edge of the Scotian Shelf. (Lee-LSWS)  
W78-07366

**SALINITY: ITS DEFINITION AND CALCULATION,**  
Department of the Environment, Victoria British (Columbia), Frozen Sea Research Group.  
For primary bibliographic entry see Field 2K.  
W78-07367

**GROUNDWATER RECHARGE AND COASTAL DISCHARGE FOR THE NORTHWEST COAST OF THE ISLAND OF HAWAII: A COMPUTERIZED WATER BUDGET APPROACH,**  
Hawaii Univ., Honolulu. Water Resources Research Center.  
For primary bibliographic entry see Field 2F.  
W78-07394

**COMPOSITION OF SUSPENSIONS AND SEDIMENTS IN THE ESTUARIES OF THE NORTHERN DVINA, MEZEN', PECHORA, AND OB' RIVERS,**  
N. P. Morozov, G. N. Baturin, V. V. Gordeyev, and Ye. G. Gurvich.  
*Soviet Hydrology: Selected Papers*, Vol 15, No 3, p 235-243, 1976. 4 fig, 5 tab, 25 ref. Translated from *Gidrokhimicheskaya Materialy*, Vol 60, p 60-73, 1974.

Descriptors: \*Sediments, \*Suspended solids, \*Estuaries, Rivers, Runoff, Particle size, Chemical analysis, Chemicals, Erosion, Suspended load, On-site investigations, On-site data collections, Data processing, \*USSR.

Terrigenous and mixed sediments cover a considerable part of the floor of the ocean. To evaluate comprehensively the process of their formation, one must have detailed data on the composition of the initial terrigenous material, most of

which is supplied to the ocean with river runoff. The suspended and dissolved substances in river runoff have been studied and give an idea of the relation between mechanical and chemical denudation on land. However, some of the studies are based on data collected at points at a considerable distance from estuaries. The amount and composition of suspensions in river estuaries may be quite different from those farther upstream. Many studies do not give data on the particle size composition of suspensions, and parallel investigations of river sediments usually are not made. For these reasons, combined investigations were performed of the suspensions and sediments in the estuaries of 4 rivers of the northern humid zone: the Northern Dvina, Mezen', Pechora, and Ob'. The material (in excess of 100 suspension samples and 24 bottom sediment samples) was collected at the end of the spring flood of 1969 in the lower reaches of these rivers, the main delta arms, and in the shore zone, whenever possible. The results of a study of the particle size and chemical composition of 36 of the most complete (according to the volume of material) of the collected suspension samples and 22 sediment samples were reported. (Sims-LSWS)  
W78-07405

**PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF NEARSHORE ZONE OF SAND KEY, FLORIDA, PRIOR TO BEACH RESTORATION. VOL. 1,**  
National Marine Fisheries Service, Panama City, FL. Gulf Coastal Fisheries Center.  
For primary bibliographic entry see Field 2J.  
W78-07407

**DEVELOPMENT OF A TWO DIMENSIONAL HYDRODYNAMIC NUMERICAL MODEL FOR USE IN A SHALLOW, WELL-MIXED ESTUARY,**  
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.  
G. F. McHugh.  
Louisiana State University Center for Wetland Resources Sea Grant Publication No. LSU-T-76-008, 1976. 173 p, 16 fig, 13 tab, 15 ref.

Descriptors: \*Estuaries, \*Hydrodynamics, \*Water levels, \*Mathematical models, Marshes, Brackish water, Mixing, \*Model studies, Tidal flow, Current velocities.

Part I details the development steps that led to the creation of a two-dimensional hydrodynamic model capable of predicting water levels and current velocities within an area of arbitrary size, shape, and boundary segments as a function of time. In Part 2, the feasibility of computing the tidal flow through a small area of marsh (roughly 1,000 x 600 sq. ft.) using equations and solution techniques described in Part 1, is demonstrated. The model allows for the inundation of and withdrawal of water from arbitrary areas of the marsh, and is quite general in regard to the size, shape, and open or closed nature of the boundaries. (NOAA)  
W78-07408

**COMPARISON OF NUMERICAL SIMULATION FLOW MODELS FOR COASTAL INLETS,**  
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.  
J. L. Machemehl, and T. C. Gopalakrishnan.  
North Carolina University Sea Grant No. 112, Reprinted from: *Hydraulics in the Coastal Zone*, Proceedings 25th Annual Hydraulics Division Specialty Conference, ASCE, Texas A and M University, Aug 10-12, 1977. 3 fig, 3 ref. NOAA-04-6-158-44054.

Descriptors: Hydraulics, \*Inlets(Waterways), \*Mathematical models, \*Flow measurement, Tidal effect, \*North Carolina, Coasts, \*Simulation analysis, \*Finite element analysis, Tidal flow, \*Masonboro Inlet(NC).

The finite difference scheme and the characteristic theory have been used in the development of numerical models for unsteady flow in coastal inlets. A numerical simulation model for the computation of flow in inlets with junctions has been developed. This model uses the Galerkin Technique with a finite element analysis. The vertically integrated equations of momentum and mass conservation are used with the appropriate boundary and initial conditions. The finite element model is used to investigate the flow in Masonboro Inlet, North Carolina. The junction conditions are introduced by the time rates of change of energy and mass flux at the junctions. The effectiveness of the 'double sweep' approach in solving the flow dynamics is described along with a discussion of appropriate shape functions. The computer results from the finite element scheme is compared with the field data and with the results from the finite difference schemes. (NOAA)  
W78-07472

**LINEAR AND NONLINEAR WAVE ACTION ESTIMATES,**  
Oregon State Univ., Corvallis. Dept. of Civil Engineering.  
R. T. Hudspeth, and L. S. Slotta.  
*Journal of the Engineering Mechanics Division*, American Society of Civil Engineers, Vol. 104, No. EM2, Proceedings Paper 13695, p 319-334, April 1978. 9 fig, 2 tab, 15 ref, 3 append. ERDA WA-76-3103.

Descriptors: \*Hydrodynamics, \*Gravity waves, \*Waves(Water), \*Oceanography, \*Hydraulics, Boundary processes, Numerical analysis, Dimensional analysis, Wavelengths, Coastal engineering, \*Wave energy, \*Stream function, Energy density, Energy flux.

The effects of nonlinearities on wave action quantities computed for irrotational surface gravity waves propagating on an inviscid incompressible fluid may be demonstrated on the relative wave steepness-relative water depth dissection plane by contours of relative errors between estimates computed by the nonlinear Dean Stream Function and by linear wave theory. The relative errors for energy density quantities and the ratio of nonlinear wave length values to linear wave length values were found to increase monotonically in magnitude with increasing Ursell number. A contour of zero relative error which intersects the breaking index in intermediate water depth and a positive extremal of relative error in deep water were found on the dissection plane for the average total energy flux estimates. (Singh-LSWS)  
W78-07485

**SUSPENDED-MATTER DISTRIBUTION IN THE NEW YORK BIGHT APEX RELATED TO HURRICANE BELLE,**  
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Atmospheric Labs.; and National Oceanic and Atmospheric Administration, Miami, FL. Marine Geology and Geophysics Lab.  
R. A. Young.  
*Geology*, Vol. 6, No. 5, p 301-304, May 1978. 4 fig, 1 tab, 16 ref.

Descriptors: \*Suspended solids, \*New York, \*Hurricanes, Distribution patterns, Sediment distribution, Spatial distributions, Sampling, Evaluation, Water temperature, Salinity, On-site investigations, \*New York Bight, \*Suspended matter, Hurricane Belle.

Suspended matter and hydrographic properties of the New York Bight apex were studied three days after passage of Hurricane Belle (August 1976). Distribution of suspended matter were found to be similar to those present during previous periods of calm summer weather. By comparing the present poststorm observations with previous poststorm sampling, it was hypothesized that dur-

ing summer a vertical mixing of the relatively ing throughout stratification for resuspension summer th mixing and cl tions for thos ecology. (Hu W78-07509

**MARINE W YORK BIG MENTAL IT TURES,**  
National A Washington For primary W78-07529

**THE RESU CRUISES IN Skidaway In L. P. Atkins Georgia Ma gram, Tech p. 51 fig, 2**

Descriptors: data, Basel re-salinity

Four ocean Georgia Bi pose of ga which to p technical re form with relationship consistent nutrient re water in th the forces distribution ing of the cases than pound res must be kn ing the ef system are W78-07537

**ENVIRON RELATIN TENANC TRACOA Texas A A ineering W. P. Jam Sea Gra November Also as C**

Descriptor: \*Managen tracoastal

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ing summer a stratified water column can restrict vertical mixing of resuspended bottom material to the relatively thin near-bottom layer, whereas mixing throughout the water column takes place during unstratified winter conditions. Clearing times for resuspended material, therefore, are shorter in summer than in winter. Both extent of vertical mixing and clearing times are important considerations for those concerned with problems of marine ecology. (Humphreys-LSWS)  
W78-07509

**MARINE WASTE DISPOSAL IN THE NEW YORK BIGHT—PUBLIC POLICY, ENVIRONMENTAL IMPACTS, AND ALTERNATIVE FUTURES.**  
National Association of Regional Councils, Washington, DC.  
For primary bibliographic entry see Field 5E.  
W78-07529

**THE RESULTS OF FOUR OCEANOGRAPHIC CRUISES IN THE GEORGIA BIGHT.**  
Skidaway Inst. of Oceanography, Savannah, GA.  
L. P. Atkinson.  
Georgia Marine Science Center Sea Grant Program, Technical Report Series No. 78-1, (1978). 77 p, 51 fig, 2 tab, 5 ref. SG-04-7-158-44126.

Descriptors: Cruises, Nutrients, Oceanographic data, Baseline studies, \*Georgia Bight, Temperature-salinity relationships.

Four oceanographic cruises were conducted in the Georgia Bight during 1973 and 1974 with the purpose of gaining background seasonal data with which to plan more specific experiments. In this technical report the data are presented in graphical form with interpretation. Temperature-salinity relationships and patterns in the Georgia Bight are consistent and reasonably predictable as are the nutrient relationships. The distribution of freshwater in the offshore waters is easily detected but the forces that disperse the waters and produce the distribution are not understood. The understanding of these processes is more important in many cases than knowing the distribution of some compound resulting from the process. The processes must be known if reasonable judgments concerning the effects of man's activities on the ocean system are to be made. (NOAA)  
W78-07537

**ENVIRONMENTAL CONSIDERATIONS RELATING TO OPERATION AND MAINTENANCE OF THE TEXAS GULF INTRACOASTAL WATERWAY.**  
Texas A and M Univ., College Station. Ocean Engineering Program.  
W. P. James, S. Giesler, R. DeOtte, and M. Inoue.  
Sea Grant Report No. TAMU-SG-78-204, November 1977. 249 p, 59 fig, 27 tab, 4 append.  
Also as COE Report No. 208. SG-04-6-158-44012.

Descriptors: \*Inland waterways, \*Land use, \*Management, Coasts, Texas, \*Texas Gulf Intracoastal Waterway, Environmental factors.

This study aims to identify potentially adverse environmental factors other than dredging associated with the operation and maintenance of the Texas Gulf Intracoastal Waterway. Field sampling was conducted along the waterway in January, May, and August 1975 to ascertain background water and sediment quality. To study the flow between Galveston Bay and Sabine Lake, a numerical model study was conducted of this reach of the waterway. Satellite imagery was used in the Lower Laguna Madre to study the circulation patterns and sedimentation rates. The following conclusions were developed: (1) The Intracoastal Waterway can transport water, pollutants, aquatic plants and animals from one river system to another; (2) the waterway and normal operational activities in the waterway did not appear to be a major source

of pollutants but elevated concentration of nutrients and metals were usually associated with freshwater inflow; (3) in shallow, open-bay reaches of the waterways, the current patterns adjacent to the channel can have a significant effect on the shoaling rate; and (4) the Intracoastal Waterway and associated dredged material islands have the potential of modifying circulation patterns and salinity levels in the bays and estuaries. (NOAA)  
W78-07538

**ENVIRONMENTAL MANAGEMENT OF A SHIP CHANNEL-HARBOR COMPLEX.**  
Texas A and M Univ., College Station. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5B.  
W78-07539

**TECHNICAL AND PHILOSOPHICAL ASPECTS OF OCEAN DISPOSAL.**  
Texas A and M Univ., College Station. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5E.  
W78-07540

**CIRCULATION. MESA NEW YORK BIGHT ATLAS MONOGRAPH 3.**  
MESA New York Bight Project Office, Albany.  
D. V. Hansen.  
New York Sea Grant Institute Report No. NYSSGP-AM-77-014, October 1977. 22 p, 7 fig, 1 tab, 26 ref, 2 maps.

Descriptors: \*Ocean currents, \*Circulation, \*Ocean tides, \*Estuaries, Seasonal variations, \*Outer Continental Shelf, \*New York Bight, Wind-driven currents, Temporal variation, Tidal effects.

Recent results indicate that the standard deviation of the currents in New York Bight, as in other oceanic areas is several times greater than the mean flow. This temporal variation is due primarily to tides and wind. Because the wind effects are random in time, various observations are not readily combined to provide a composite description. Data from systematic observation projects have revealed some major features of circulation in the Bight, but do not yet allow description of many details. The major feature of Bight circulation is a relatively slow flow to the southwest over most of the outer continental shelf with some indication of a clockwise eddy in the inner Bight. There is the expected exchange circulation, characterized by seaward flow of estuarine waters near the surface and landward flow of deeper waters between the Hudson/Raritan estuary and the offshore waters, and there is some indication that the landward flow may extend as far as 64 km (40 mi) offshore in the Hudson Shelf Valley. All of these features are masked primarily by stronger but variable wind-driven currents on a day-to-day basis, and may be drastically altered for periods of several weeks. This is especially so during summer in conjunction with sustained periods of little rainfall or strong southerly winds. (NOAA)  
W78-07541

**WATER QUALITY. MESA NEW YORK BIGHT ATLAS MONOGRAPH 27.**  
MESA New York Bight Project, Office, Albany.  
For primary bibliographic entry see Field 5B.  
W78-07542

**NEARSHORE FISH AND MACROINVERTEBRATE ASSEMBLAGES ALONG THE STRAIT OF JUAN DE FUCA INCLUDING FOOD HABITS OF NEARSHORE FISH.**  
National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.  
C. A. Simenstad, B. S. Miller, J. N. Cross, K. L. Fresh, and S. N. Steinfort.

NOAA Technical Memorandum ERL MFSA-20, December 1977. 154 p, 25 fig, 17 tab, 22 ref, 9 append.

Descriptors: \*Fish, \*Invertebrates, \*Baseline studies, \*Food habits, Standing crops, Biomass, Water pollution sources, Washington, Canada, \*Outer Continental Shelf, \*Strait of Juan de Fuca, Oil transport.

In response to potential oil shipment to or through the Strait of Juan de Fuca, this baseline study was initiated to document the distribution, abundance, and biomass of the nearshore fish, to determine the food habits of the fish and to identify and catalogue the macroinvertebrates collected incidentally with the fish. Seventy species of fish were collected by beach seine (demersal fishes) and tow net (neritic species). Species richness increased from west to east. Fish were generally most abundant during the summer; reduced abundances typified winter collections. Standing crop was greatest during summer and fall and least during winter and spring. One hundred and fifteen species of macroinvertebrates were collected with the fish. The highest values were usually recorded during the spring and the lowest during the fall. Nearshore demersal fish fed predominantly upon epibenthic crustaceans. Nearshore neritic fishes most frequently preyed upon pelagic invertebrates. (NOAA)  
W78-07543

**EVALUATION OF WATER QUALITY OF PUGET SOUND AND HOOD CANAL IN 1976.**  
National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.  
For primary bibliographic entry see Field 5C.  
W78-07544

**SURFACE DRIFTER MOVEMENTS OBSERVED IN OUTER STRAIT OF JUAN DE FUCA, JULY 1977.**  
National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.  
For primary bibliographic entry see Field 5B.  
W78-07545

**SOME PARASITES AND DISEASES OF ESTUARINE FISHES IN POLLUTED HABITATS OF MISSISSIPPI.**  
Gulf Coast Research Lab., Ocean Springs, MS.  
For primary bibliographic entry see Field 5C.  
W78-07546

**INDUSTRIAL WASTES. MESA NEW YORK BIGHT ATLAS MONOGRAPH 30.**  
New York Sea Grant Inst., Albany.  
For primary bibliographic entry see Field 5B.  
W78-07547

**THE 1973 BATHYMETRIC SURVEY IN THE NEW YORK BIGHT APEX: MAPS AND GEOLOGICAL IMPLICATIONS.**  
National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.  
G. L. Freeland, and G. F. Merrill.  
NOAA Technical Memorandum ERL MESA-19, December 1977. 22 p, 6 fig, 2 tab, 11 ref.

Descriptors: \*Waste disposal, \*Maps, \*Sedimentation, Charts, Surveys, \*New York Bight, \*Hydrographic surveys, \*Bathymetric surveys, Dredge Spoil dumpsite, Ocean dumping, \*Outer Continental Shelf.

A hydrographic survey of the New York Bight Apex was undertaken by the New York District of the Corps of Engineers under contract to NOAA as part of the MESA Program. A bathymetric map

## Field 2—WATER CYCLE

### Group 2L—Estuaries

was prepared and a comparison was made between the 1973 data and hydrographic data from the most recent previous survey of the area, H-6190, done in 1936 by the U.S. Coast and Geodetic Survey. A resulting contoured net bathymetric change map shows that the most significant change has occurred in the dredge-spoil dumpsite, where there has been up to 10 m of shoaling. Calculations of volumes of eroded and deposited sediment indicate that the area has generally eroded and that, except at the dredge-spoil dumpsite and the now abandoned dumpsites near Ambrose and Sandy Hook Channels, dumping is not causing significant changes in water depths. (NOAA)  
W78-07548

**NUTRIENT DISTRIBUTIONS AND TRANSPORT IN LONG ISLAND SOUND,**  
State Univ. of New York at Stony Brook. Marine Sciences Research Center.  
For primary bibliographic entry see Field 5B.  
W78-07550

**USE OF BENTHIC SEDIMENTS AS INDICATORS OF MARINA FLUSHING,**  
Oregon State Univ., Corvallis. Dept. of Ocean Engineering.  
For primary bibliographic entry see Field 5A.  
W78-07553

**GENERATION OF TIDAL CURRENT AND HEIGHT CHARTS FOR NARRAGANSETT BAY USING A NUMERICAL MODEL,**  
Rhode Island Univ., Kingston. Dept. of Ocean Engineering.  
C. Swanson, and M. Spaulding.  
Rhode Island University, Department of Ocean Engineering. Marine Technical Report No. 61, 1977. 13 p., 4 fig., 1 tab., 5 ref. SG-04-6-158-44002.

Descriptors: \*Estuaries, \*Tides, \*Mathematical models, \*Rhode Island, Model studies, \*Tidal currents, \*Narragansett Bay(RI), \*Tidal height charts.

A series of tidal current and height charts were prepared for Narragansett Bay, Rhode Island utilizing a numerical model. The format of these charts is designed to allow the recreational user to easily determine the tidal currents and height at any location and time. The numerical model used is two dimensional, vertically averaged, multi-topography, alternating direction implicit finite difference scheme. To facilitate the use of the charts a 10 year tide table was constructed from the tidal height data. The tidal height and velocity data were presented in a series of 13 hourly charts referenced to high water at Newport, Rhode Island covering one complete tidal cycle. To assist users in interpreting the charts a digitized outline of Narragansett Bay was created. In addition, the islands, towns, and points were labeled on the plotted outline. (NOAA)  
W78-07555

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL REPORTS SUMMARY FOR THE YEAR ENDING MARCH 1977.**  
Science Applications, Inc., Boulder, CO.  
For primary bibliographic entry see Field 6G.  
W78-07557

**MICROBIAL INTERACTIONS WITH PESTICIDES IN ESTUARINE SURFACE SLICKS,**  
Georgia State Univ., Atlanta. Dept. of Biology.  
For primary bibliographic entry see Field 5C.  
W78-07605

**CHLORINATED HYDROCARBONS IN MACROINVERTEBRATES AND FISH FROM THE LOWER MEDWAY ESTUARY, KENT,**  
John Cass Coll., London (England).

For primary bibliographic entry see Field 5C.  
W78-07661

**A PRELIMINARY STUDY OF THE USE OF BENTHIC ALGAE AS BIOLOGICAL INDICATORS OF HEAVY METAL POLLUTION IN SORFJORDEN, NORWAY,**  
Central Inst. for Industrial Research Oslo (Norway).  
For primary bibliographic entry see Field 5A.  
W78-07665

**MODEL STUDY OF COOL WATER DISCHARGE FROM PROPOSED LNG FACILITY, LOS ANGELES HARBOR, CALIFORNIA,**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
For primary bibliographic entry see Field 5B.  
W78-07669

**DISPERSION OF PROPOSED EFFLUENT DISCHARGES AND SALTWATER INTRUSION IN COOPER RIVER; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
For primary bibliographic entry see Field 5B.  
W78-07670

**IMPROVEMENTS FOR LITTLE RIVER INLET, SOUTH CAROLINA; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
For primary bibliographic entry see Field 8B.  
W78-07671

**SOIL STRENGTH AND SOIL TEMPERATURE: THEIR EFFECTS ON ROOT GROWTH OF TALL FESCUE,**  
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.  
For primary bibliographic entry see Field 2G.  
W78-07688

## 3. WATER SUPPLY AUGMENTATION AND CONSERVATION

### 3A. Saline Water Conversion

**CONCENTRATION OF ACETIC ACID IN SULFITE PULP EVAPORATION DRAIN BY REVERSE OSMOSIS,**  
National Chemical Lab. for Industry, Tokyo (Japan).  
For primary bibliographic entry see Field 5D.  
W78-07598

**AN ASSESSMENT OF IRRIGATION EFFICIENCIES AND DRAINAGE RETURN FLOWS FROM THE WELTON-MOHAUK DIVISION OF THE GILA PROJECT,**  
Bureau of Reclamation, Yuma, AZ. Yuma Projects Office.  
For primary bibliographic entry see Field 3C.  
W78-07644

### 3C. Use Of Water Of Impaired Quality

**ECONOMIC IMPACT OF WATER QUALITY ON RIVER BASIN MANAGEMENT,**  
California Univ., Davis. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07396

**PROCEEDINGS OF NATIONAL CONFERENCE: IRRIGATION RETURN FLOW QUALITY MANAGEMENT.**  
Colorado State Univ., Fort Collins.  
For primary bibliographic entry see Field 5G.  
W78-07606

**SIMULATION OF NITROGEN MOVEMENT, TRANSFORMATIONS, AND PLANT UPTAKE IN THE ROOT ZONE,**  
Florida Univ., Gainesville. Dept. of Soil Science.  
For primary bibliographic entry see Field 5B.  
W78-07608

**NITROGEN AND WATER MANAGEMENT TO MINIMIZE RETURN-FLOW POLLUTION FROM POTATO FIELDS OF THE COLUMBIA BASIN,**  
Washington State Univ., Pullman. Dept. of Agronomy and Soils.  
For primary bibliographic entry see Field 5G.  
W78-07611

**MINIMIZING SALT IN RETURN FLOW BY IMPROVING IRRIGATION EFFICIENCY,**  
Agricultural Research Service, Riverside, CA. Salinity Lab.  
For primary bibliographic entry see Field 5G.  
W78-07616

**MODELING SALINITY OF IRRIGATION RETURN FLOW WHERE SOURCES AND SINKS ARE PRESENT,**  
Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.  
For primary bibliographic entry see Field 5B.  
W78-07617

**FIELD EVALUATION OF SPRINKLER IRRIGATION FOR MANAGEMENT OF IRRIGATION RETURN FLOW,**  
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07618

**EFFECTS OF IRRIGATION MANAGEMENT ON SOIL SALINITY AND RETURN FLOW QUALITY,**  
New Mexico State Univ., University Park. Dept. of Agronomy.  
For primary bibliographic entry see Field 5G.  
W78-07619

**SCIENTIFIC IRRIGATION SCHEDULING FOR SALINITY CONTROL OF IRRIGATION RETURN FLOW,**  
Agricultural Research Service, Kimberly ID. Snake River Conservation Research Center.  
For primary bibliographic entry see Field 5G.  
W78-07621

**COMBINING AGRICULTURAL IMPROVEMENTS AND DESALTING OF RETURN FLOWS TO OPTIMIZE LOCAL SALINITY CONTROL POLICIES,**  
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07628

**AREAL PREDICTIONS OF SOIL WATER FLUX IN THE UNSATURATED ZONE,**  
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.  
For primary bibliographic entry see Field 2G.  
W78-07630

**HYDRO-SALINITY INPUT VARIATION**  
Agricultural Research Service, Fort Collins. Lab.  
For primary bibliographic entry see Field 5G.  
W78-07632

**APPLICATION OF TECHNOLOGY TO IRRIGATION IN NEW MEXICO**  
New Mexico State Univ., Agricultural Experiment Station. T. W. Sammis. In: Proceedings of the National Conference on Return Flow Quality Management, Fort Collins, CO, 1976, May 16-17.

Descriptors: Irrigation efficiency, \*Return flow, Root zone, \*Mesilla Valley.

Current engineering demonstration project in Mexico to determine the large scale drainage. The project is planned by irrigation engineers. A series of results from the project are presented. More than 50 percent of the growth rate of the irrigation scheduling timing of the soil conditions. Monitoring of the irrigation Farm returns. The project is for wheat to determine the alfalfa water which controls the applied water enabling the and buildup increased irrigation from the Department of Cooperative Extension program. The project is a public awareness program in the field and field data. Colorado State Univ., Fort Collins. W78-07634

**LOCAL PROBLEMS WITH WESTLANDS**  
Westlands Water Foundation. For primary bibliographic entry see Field 5G.  
W78-07638

**THE 1973 RIVER STATES AT COLORADO RIVER**  
For primary bibliographic entry see Field 5G.  
W78-07643

**AN ASSESSMENT OF THE WELTON-MOHAUK DIVISION OF THE GILA PROJECT**  
Bureau of Reclamation, Yuma, AZ. Yuma Projects Office. D. L. Krull. In: Proceedings of the National Conference on Return Flow Quality Management, Fort Collins, CO, 1976, May 16-17.



## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Conservation In Agriculture—Group 3F

**HYDRO-SALINITY MODELS: SENSITIVITY TO INPUT VARIABLES.**  
Agricultural Research Service, Riverside. Salinity Lab.  
For primary bibliographic entry see Field 5B.  
W78-07632

**APPLICATION OF MODERN IRRIGATION TECHNOLOGY IN THE MESILLA VALLEY, NEW MEXICO.**  
New Mexico State Univ., University Park. Dept. of Agricultural Engineering.  
T. W. Sammis, and C. M. Hohn.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 269-276, May 16-19, 1977. 2 fig, 4 tab, 3 ref.

Descriptors: Irrigation systems, Surface irrigation, \*Irrigation efficiency, \*Saline soils, Rio Grande River, \*Return flow, Irrigation, Orchards, Alfalfa, Root zone, \*New Mexico, \*Salts, Salinity, \*Mesilla Valley (N.Mex.).

Current engineering technology is being applied to a Demonstration Farm in the Mesilla Valley, New Mexico to demonstrate the feasibility of decreasing the large amount of salt returned to the Rio Grande River System through return flow drainage. The reduction in return flow is accomplished by irrigation scheduling techniques and more efficient irrigation methods, such as drip irrigation. A small pecan orchard has been converted from flood irrigation to drip irrigation resulting in the water application reduction greater than 50 percent with a marked visible increase in growth rate over that of the previous year. Irrigation scheduling increased the efficiency of irrigation timing on the farm resulting in an improved soil condition, in some cases one less irrigation. Monitoring of the applied water on the Demonstration Farm resulted in estimates of irrigation efficiencies for the season ranging from 54 percent for wheat to 97 percent for alfalfa. The high efficiency for alfalfa was probably due to the high water table which contributed water to the crops in addition to the applied water. Monitoring of the soil salinity is enabling the investigators to follow the movement and buildup of salt below the root zone with increased irrigation efficiencies. Information gained from the Demonstration Farm is being used by the Cooperative Extension Service in an educational program. The various methods used to make the public aware of EPA's efforts on the Demonstration Farm include media releases, tour brochures, and field days. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07634

**LOCAL SOLUTIONS TO DRAINAGE PROBLEMS.**  
Westlands Water District, Fresno, CA.  
For primary bibliographic entry see Field 4A.  
W78-07638

**THE 1973 AGREEMENT ON COLORADO RIVER SALINITY BETWEEN THE UNITED STATES AND MEXICO.**  
Colorado River Board of California, Los Angeles.  
For primary bibliographic entry see Field 6E.  
W78-07643

**AN ASSESSMENT OF IRRIGATION EFFICIENCIES AND DRAINAGE RETURN FLOWS FROM THE WELLTON-MOHAWK DIVISION OF THE GILA PROJECT.**  
Bureau of Reclamation, Yuma, AZ. Yuma Projects Office.  
D. L. Krull, and D. L. Clark.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 335-348, May 16-19, 1977. 5 fig, 4 ref.

Descriptors: \*Desalination, \*Arizona, \*Irrigation efficiencies, Drainage, \*Return flow, Drainage water, Irrigation, \*Wellton-Mohawk project (Ariz.).

Public Law 93-320 authorized the construction of a large desalting plant to enable the United States to comply with its obligation under the agreement with Mexico of August 30, 1973 (Minute No. 242 of the International Boundary and Water Commission, United States and Mexico). The desalting plant will be constructed to treat the drainage waters from the Wellton-Mohawk Division of the Gila Project so these waters will be available for delivery to Mexico under the 1944 Mexican Water Treaty and Minute No. 242. By reducing the volume of drainage flows, the size of the desalting plant can be reduced. An interagency committee was established to determine and implement means of increasing irrigation efficiencies so as to reduce drainage return flows to the lowest practical volume and to identify an optimal economic solution relating desalting costs to specified irrigation efficiency levels. An assessment was made utilizing the water budget process to determine the relationship between increased irrigation efficiency levels and drainage return flows. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07644

**WELLTON-MOHAWK ON-FARM SYSTEMS IMPROVEMENT PROGRAM.**  
Soil Conservation Service, Phoenix, AZ.  
R. S. Swenson.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 349-351, May 16-19 1977. 1 tab, 2 ref.

Descriptors: Irrigation, Irrigation systems, Irrigation practices, \*Irrigation efficiency, \*Return flow, \*Arizona, \*Wellton-Mohawk project (Ariz.), \*Salinity, Water conservation.

The objective of the Soil Conservation Service, (SCS) in the Wellton-Mohawk Irrigation Improvement Program is to increase irrigation efficiency on farms in the district and thereby reduce return flows from the district. To accomplish this, the SCS enters into contracts with eligible landowners and operators to implement conservation practices that will further the program goals. Cost sharing is provided on a 75% federal, 25% cooperator basis. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07645

**RESEARCH AND DEMONSTRATION APPROACH TO DEVELOPMENT OF APPROPRIATE SALINITY CONTROL TECHNOLOGIES FOR GRAND VALLEY.**  
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07646

**THE HYDRO-SALINITY SYSTEM IN THE GRAND VALLEY.**  
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07647

**MODELING SALT TRANSPORT IN THE IRRIGATED SOILS OF GRAND VALLEY.**  
Maryland Univ., College Park. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5B.  
W78-07648

**EVALUATING APPROPRIATE TECHNOLOGIES FOR SALINITY CONTROL IN GRAND VALLEY.**  
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.  
For primary bibliographic entry see Field 5G.

W78-07649

**DEVELOPMENT OF BEST MANAGEMENT PRACTICES FOR SALINITY CONTROL IN GRAND VALLEY.**  
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07650

### 3D. Conservation In Domestic and Municipal Use

**HYDROGEOLOGY OF METROPOLITAN CHRISTCHURCH.**  
New Zealand Geological Survey, Christchurch.  
For primary bibliographic entry see Field 4B.  
W78-07368

**TRANSFORMATION OF THE HYDROLOGIC BUDGET OF THE MOSCOW CITY AREA.**  
For primary bibliographic entry see Field 4C.  
W78-07376

**REUSE OF MUNICIPAL WASTEWATER FOR GROUNDWATER RECHARGE.**  
SCS Engineers, Inc., Long Beach, CA.  
For primary bibliographic entry see Field 5D.  
W78-07570

### 3E. Conservation In Industry

**REMOVAL OF CHROMIUM, CHROMATE, MOLYBDATE AND ZINC.**  
Chemical Separations Corp, Oak Ridge, TN. (Assignee).  
For primary bibliographic entry see Field 5D.  
W78-07231

**ENERGY AND WATER.**  
California Univ., Berkeley. Lawrence Berkeley Lab.; and California Univ., Berkeley. Div. of Energy and Environment.  
For primary bibliographic entry see Field 6D.  
W78-07508

**PLATER MEETS 'NEW SOURCE' REQUIREMENTS.**  
For primary bibliographic entry see Field 5D.  
W78-07593

**AN ENERGY MODEL OF PENNSYLVANIA.**  
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.  
For primary bibliographic entry see Field 6A.  
W78-07685

### 3F. Conservation In Agriculture

**IRRIGATION GRAVEL GUARD.**  
R. A. Scott.  
U.S. Patent No. 4,057,968, 5 p, 7 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 3, p 736, November 15, 1977.

Descriptors: \*Patents, \*Irrigation, \*Irrigation efficiency, Irrigation practices, Application equipment, Gravels.

A gravel guard is used in irrigation pipes and couplers to prevent gravel or the like from flowing through the pipe and so prevent clogging of the sprinkler heads. An irrigation gravel guard comprises a ring shaped support having a substantially conical shaped screen secured to it and extending from it. One end of the screen is open and is

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3F—Conservation In Agriculture

secured to the ring shaped support by welding. The other end of the screen is rolled or crimped upon itself to close the other end except for perforations extending through it. An extension may be welded to the end of the gravel guard to effectively increase the over-all length. (Sinha-OEIS)  
W78-07235

#### AERATION TUBE,

G. M. Pollart.  
U.S. Patent No. 4,058,261, 5 p, 4 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 3, p 835, November 15, 1977.

Descriptors: \*Patents, \*Irrigation, \*Irrigation systems, \*Irrigation efficiency, Irrigation practices, Water delivery, Application equipment, Aeration, Diffusers.

Frequently water jets or streams are discharged from large irrigation pipes at sufficient velocity, and over sufficiently extended periods of time, that the soil is washed away or eroded around plants and damage to the crop can result as well as loss of topsoil. This invention comprises a diffusion tube which is useful on a variety of types of irrigation pipe. The diffusion tube is a shapeable, deformable tubular portion which can be pressed over a spigot or spout formed on the irrigation pipe, or can be pressed through a slot or hole cut in the side of the pipe. The invention provides a diffusion or aeration apparatus which functions to receive relatively high velocity water from the irrigation pipe and subject it to a diffusing process which breaks up the water stream and reduces the erosive effect of the discharged water when it contacts the earth to be irrigated. (Sinha-OEIS)  
W78-07237

#### MOISTURE SENSING APPARATUS AND METHOD,

Toro Co., San Marcos, CA. (Assignee).  
E. J. Hunter.  
U.S. Patent No. 4,059,227, 8 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1167, November 22, 1977.

Descriptors: \*Patents, \*Irrigation systems, \*Water control, \*Irrigation efficiency, Automatic control, Moisture, Humidity, Weather, Sensors.

This invention provides a moisture sensing control system for controlling watering periods of an irrigation system in response to ambient weather condition. This is accomplished by exposing water in a container to the atmosphere, sensing changes in the volume of the exposed water due to ambient weather conditions, controlling an electrical signal related to the sensed change and controlling the operation of an irrigation system, such as solenoid-actuated pilot valves associated with sprinklers of the irrigation system, in response to the signal. (Sinha - OEIS)  
W78-07242

#### SELF CLEANING, PRESSURE RESPONSIVE EMITTER VALVE FOR SOIL IRRIGATION,

Salco Products, Inc., Hawthorne, CA. (Assignee).  
D. Werner.  
U.S. Patent No. 4,059,228, 15 p, 31 fig, 15 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1167, November 22, 1977.

Descriptors: \*Patents, \*Irrigation, \*Irrigation practices, \*Irrigation efficiency, Water delivery, Application equipment, \*Valves.

The emitter-valve includes a deformable element placed within a cavity. The element has a stem which extends within a water inlet to the cavity or a base which rests on the inlet wall on the bottom of the cavity so that, upon supply of water, the element moves upward against a wall having a water outlet to permit water to flow. A groove across the element top cooperates with an annular protuberance on the water outlet wall so that, as water pressure rises, water flow decreases and, as water pressure decreases, water flow increases. Further included are three deformable fingers of springy material which normally space the element from the water outlet and which briefly resist upward movement of the element and contact of the groove with the annular protuberance upon initial water turn-on to permit the water to spurt through the valve outlet and to carry with it any lodged solid particulate matter. Also, upon initial water shut-off, the springy fingers suddenly move the element to permit another surge of water through the outlet as water backpressure is relieved. (Sinha - OEIS)  
W78-07243

U.S. Patent No. 4,059,229, 5 p, 3 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1168, November 22, 1977.

#### TRAVELING SPRINKLER GUIDE WHEEL ASSEMBLY,

Nelson (L. R.) Corp., Peoria, IL. (Assignee).  
J. R. Pescetto.  
U.S. Patent No. 4,059,229, 5 p, 3 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1168, November 22, 1977.

Descriptors: \*Patents, \*Irrigation, \*Sprinkler irrigation, \*Application equipment, Irrigation efficiency, Irrigation practices, Traveling sprinklers.

A traveling sprinkler is provided which comprises an elongated sprinkler body having a water distributing apparatus connected to it; a pair of cleated drive wheels mounted on either side of the sprinkler body; and means for guiding the movement of the sprinkler body in a given direction. The guiding means includes a split freely idling guide wheel having two halves mounted for rotation about a horizontal axis and for rotation with respect to the body about a vertical axis. The guide wheel is radially slotted, to improve the traction, and to make it ride lower. The horizontal axis of the guide wheel is defined by a shaft, and the means for mounting the guide wheel includes a forked bracket having portions engaging opposed ends of the shaft, and having an upwardly extending shaft portion. (Sinha - OEIS)  
W78-07244

#### IRRIGATION WATER SUPPLY STUDY FOR RED PRAIRIE IRRIGATION DISTRICT, POLK AND YAMHILL COUNTIES, OREGON.

Oregon Water Resources Board, Salem.  
June 1976, 14 p, 2 fig, 2 tab.

Descriptors: \*Irrigation, \*Reservoirs, \*Pipelines, \*Oregon, Irrigation districts, Costs, Irrigation programs, Agriculture, Distribution systems, Dams, Feasibility studies, Streams, \*Red Prairie(OR), Willamette River(OR).

Comparison of several pipe systems and potential reservoir sites showed that a 17,000 acre-ft reservoir (site 3), with runoff supplemented by pumping from Mill Creek, best satisfied requirements of the Red Prairie Irrigation District (Polk and Yamhill Counties, OR). A system of pipelines and pumps, designed to distribute the water to 11,800 acres of cropland, includes three mainlines and their laterals. The estimated annual cost for the dam, reservoir, and distribution system is \$78.49 per acre at 10% and 30 years, or \$48.83 per acre at 5% and 40 years. Total construction costs are estimated at \$3.6 million for the dam and reservoir, and \$3.4 million for the distribution system. Fifteen other reservoir sites were also examined, as well as three pipeline routes from the Willamette River to the project area via release into Salt Creek. To determine reservoir site economic feasibility, a ratio of embankment over capacity (E/C) was used; in general the greater the E/C value, the less economical the site. Other considerations were road relocation, right-of-way purchase, and utilities relocation. It would be possible for landowners to furnish their own distribution systems, but the open system thus required would be subject to water losses through evaporation, seepage, and excess releases, which would impair reservoir efficiency. (Lynch-Wisconsin).

W78-07282

#### EFFECT OF THE SMALL WATERSHED PROGRAM ON MAJOR USES OF LAND: EXAMINATION OF 60 PROJECTS IN THE SOUTHEAST, MISSISSIPPI DELTA, AND MISSOURI RIVER TRIBUTARIES REGIONS,

Economics, Statistics, and Cooperative Service, Washington, DC. Natural Resource Economics Div.  
For primary bibliographic entry see Field 4D.  
W78-07330

#### ECONOMIC AND AGRONOMIC EFFECTS OF HIGH IRRIGATION LEVELS ON ALFALFA AND BARLEY,

Wyoming Univ., Laramie. Water Resources Research Inst.  
R. H. Delaney, J. J. Jacobs, J. Borrelli, R. T. Clark, and W. E. Hedstrom.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 804. Price codes: A05 in paper copy, A01 in microfiche. Wyoming Agricultural Experiment Station, Research Journal 121; and Water Resources Series No. 68, January 1978. 78 p, 7 fig, 27 tab, 46 ref. OWRT C-5236(No. 4229)(1).

Descriptors: \*Irrigation effects, \*Agronomic crops, \*Drainage, \*Agricultural economics, Income, Labor savings, Profit, Surface irrigation, Crop response, Irrigation efficiency, Leaching, Water injury, Alfalfa, Barley, \*Irrigation practices, Feed barley, Malt barley, Overirrigation, Excess water.

Five water levels were used on alfalfa, feed barley, and malt barley. Treatments 2, 4 and 5 were irrigated with quantities of water sufficient to bring the soil to field capacity (FC) from 50% of the available moisture (AM), twice this quantity and four times this quantity, respectively. Treatments 1 and 3 were irrigated to FC when 90 and 10% respectively, of the AM was depleted. The highest irrigation level on alfalfa yielded an average of 2 mt/ha/yr less than level 1 over the 3 year study and 1-1/2 mt/ha/yr less than level 2, which was the check treatment. The phosphorus content of the forage was reduced by the two driest irrigation levels and could require P supplementation when fed to some classes of livestock. The yield of feed barley for the highest irrigation level was reduced 18% when compared to the driest treatment. The average yield of malt barley for the 2 years was reduced 22% by irrigation level 5 compared to irrigation level 1. An economic analysis of the plot yield data showed that irrigation practice No. 1 provided the largest return to management and land. These results suggest that irrigators might be able to reduce the quantity of water used and increase yields as well. An analysis of the yield data for crops, both with and without irrigation scheduling (IS), showed that yields were generally higher when a crop was under IS. An economic analysis of the yield increase for alfalfa and barley indicated that the increased yield would more than pay for the cost of the IS service. For the given physical situation and irrigation practices similar to those used in water level 3, the drainage system would cost \$86/ha/yr, for water level 4-\$272/ha/yr, and for water level 5-\$1038/ha/yr.  
W78-07397

#### WESTERN KANSAS FACES DECLINING WATER TABLE.

For primary bibliographic entry see Field 4B.  
W78-07583

#### THE ROLE OF EPA'S OFFICE OF RESEARCH AND DEVELOPMENT IN IRRIGATED CROP PRODUCTION RESEARCH,

Environmental Research Lab., Ada, OK. Office of Research and Development.  
For primary bibliographic entry see Field 5G.  
W78-07607

EFFECT OF WATER USE E SOLUTE CONC Texas Agriculture For primary bib W78-07620

MANAGEMENT TROLLING SI ADSORBED RETURN FLOW Cultural Resea River Conserva For primary bib W78-07622

QUALITY OF FROM FLOOD California Uni Sciences. For primary bib W78-07623

AN ECONOMIC RETURN FLO CENTRAL VA California Uni Economics. For primary bib W78-07625

ON-FARM N SEDIMENT Idaho Univ., engineering. For primary bib W78-07626

ECONOMIC METHODS AND NUTRIE Idaho Univ., For primary bib W78-07627

PRACTICAL RETURN F LARGE ACR Bureau of Re and Research For primary bib W78-07629

WATER DI SPRINKLER SYSTEMS, Colorado St Agricultural a D. Karmeli. In: Proceedin tion Return State Univer 251, May 16-

Descriptors: us, \*Sprinkl \*Distribution

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## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Control Of Water On The Surface—Group 4A

#### EFFECT OF IRRIGATION SYSTEMS ON WATER USE EFFICIENCY AND SOIL WATER SOLUTE CONCENTRATIONS,

Texas Agricultural Experiment Station, Lubbock.  
For primary bibliographic entry see Field 5G.  
W78-07620

#### MANAGEMENT GUIDELINES FOR CONTROLLING SEDIMENTS, NUTRIENTS, AND ADSORBED BIOCIDES IN IRRIGATION RETURN FLOWS,

Cultural Research Service, Kimberly ID. Snake River Conservation Research Center.  
For primary bibliographic entry see Field 5G.  
W78-07622

#### QUALITY OF IRRIGATION RETURN FLOW FROM FLOODED RICE PADDIES,

California Univ., Davis. Dept. of Soil and Crop Sciences.  
For primary bibliographic entry see Field 5B.  
W78-07623

#### AN ECONOMIC ANALYSIS OF IRRIGATION RETURN FLOW RECYCLE SYSTEMS IN THE CENTRAL VALLEY OF CALIFORNIA,

California Univ., Davis. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 5G.  
W78-07625

#### ON-FARM METHOD FOR CONTROLLING SEDIMENT AND NUTRIENT LOSSES,

Idaho Univ., Moscow. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07626

#### ECONOMIC ANALYSIS OF ON-FARM METHODS FOR CONTROLLING SEDIMENT AND NUTRIENT LOSSES,

Idaho Univ., Moscow.  
For primary bibliographic entry see Field 5G.  
W78-07627

#### PRACTICAL APPLICATIONS OF IRRIGATION RETURN FLOW QUALITY MODELS TO LARGE ACREAGES,

Bureau of Reclamation, Denver, CO. Engineering and Research Center.  
For primary bibliographic entry see Field 5G.  
W78-07629

#### WATER DISTRIBUTION PATTERNS FOR SPRINKLER AND SURFACE IRRIGATION SYSTEMS,

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.  
D. Karmeli.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 233-251, May 16-19, 1977. 11 fig, 4 tab, 19 ref.

Descriptors: \*Model studies, \*Simulation analysis, \*Sprinkler irrigation, \*Irrigation efficiency, \*Distribution patterns.

A linear fit model for sprinkler and power curve fit model for surface irrigation systems are suggested to represent actual patterns of distributions in irrigated fields. Both models allow for efficient calculation of surplus and deficient volumes, as well as the various relevant efficiencies. Both environmental and economical aspects require desired efficiency combinations to be followed and this may be done when the irrigation systems are represented by the suggested models. Also, the various functions related to irrigation performance, may be integrated to reach optimal results. (See also W78-7606) (Skogerboe-Colorado State)

W78-07631

#### AGRICULTURAL DRAINAGE PROBLEMS OF THE SAN JOAQUIN VALLEY,

Bureau of Reclamation, Sacramento, CA. Mid-Pacific Regional Office.  
For primary bibliographic entry see Field 4A.  
W78-07636

#### HOW THE NPDES PROGRAM WILL DEFINE PRESENT WATER QUALITY CONDITIONS,

Central Valley Regional Water Quality Control Board, Sacramento, CA.  
For primary bibliographic entry see Field 5G.  
W78-07637

#### IRRIGATION RETURN FLOW PROBLEMS IN YAKIMA VALLEY,

Washington State Dept. of Ecology, Olympia.  
For primary bibliographic entry see Field 5G.  
W78-07640

#### THE SULPHUR CREEK PILOT PROJECT: A PRACTICAL APPROACH TO CONTROL OF POLLUTANTS LEAVING IRRIGATED FARMLANDS,

Washington State Dept. of Ecology, Olympia.  
For primary bibliographic entry see Field 5G.  
W78-07641

#### INTERFACE OF WATER QUANTITY AND QUALITY LAWS IN THE WEST,

Colorado State Univ., Fort Collins. Dept. of Economics.  
For primary bibliographic entry see Field 6E.  
W78-07652

#### AN INFLUENT CONTROL APPROACH TO IRRIGATION RETURN FLOW QUALITY MANAGEMENT,

Colorado State Univ., Fort Collins. Dept. of Economics.  
For primary bibliographic entry see Field 5G.  
W78-07653

#### A PROCESS FOR IDENTIFYING, EVALUATING AND IMPLEMENTING SOLUTIONS FOR IRRIGATION RETURN FLOW PROBLEMS,

Colorado State Univ., Fort Collins. Dept. of Sociology.  
For primary bibliographic entry see Field 5G.  
W78-07654

### 4. WATER QUANTITY MANAGEMENT AND CONTROL

#### 4A. Control Of Water On The Surface

#### WIND POWERED ARTIFICIAL AERATION OF NORTHERN PRAIRIE LAKES,

North Dakota State Univ., Fargo. Dept. of Mechanical Engineering.  
For primary bibliographic entry see Field 8C.  
W78-07201

#### NONSTRUCTURAL FLOODPLAIN PLANNING,

State Univ. of New York at Buffalo. Dept. of Industrial Engineering.  
For primary bibliographic entry see Field 6F.  
W78-07221

#### INVENTORY OF LAKE ONTARIO INLETS AND HARBORS: NIAGARA RIVER TO STONY CREEK,

State Univ. of New York at Buffalo. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2H.  
W78-07225

#### PLANNING GUIDELINES FOR RESIDENTIAL AND PATH DEVELOPMENT IN MICHIGAN'S SAND DUNES AND WETLANDS.

Mann (Roy) Associates, Inc., Cambridge, MA.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 844. Price codes: A03 in paper copy, A01 in microfiche. Prepared for Michigan Department of Natural Resources, Lansing, Water Development Services Division, and NOAA Office of Coastal Zone Management, Rockville, Md. May 1975. 32 p, 6 ref.

Descriptors: \*Dunes, \*Wetlands, \*Conservation, \*Construction, Planning, \*Land use, Land management, Road construction, Coasts, Resource development, \*Michigan, Sand dunes.

Guidelines are provided for landowners on the development and preservation of sand dunes and wetlands. Problems associated with these communities are explained as well as possible alternative or mitigating developmental measures. Building designs and considerations for roads, paths, and buildings are discussed with emphasis on preserving both the natural communities and the structures. (Steiner-Mass)

W78-07227

#### EFFECTS OF STREAM CHANNELIZATION ON TERRESTRIAL WILDLIFE AND THEIR HABITATS IN THE BUENA VISTA MARSH, WISCONSIN,

Wisconsin Cooperative Fishery Research Unit, Stevens Point.  
For primary bibliographic entry see Field 6G.  
W78-07228

#### SHORELINE PLANT ESTABLISHMENT AND USE OF A WAVE-STILLING DEVICE,

Texas A and M Univ., College Station.  
For primary bibliographic entry see Field 2I.  
W78-07230

#### BENTHIC SEMI-BARRIER TO CONTROL THE GROWTH OF WEEDS IN AQUATIC ENVIRONMENTS,

For primary bibliographic entry see Field 5G.  
W78-07257

#### FLOOD DAMAGES ON THE IOWA RIVER,

Iowa Univ., Iowa City. Inst. of Hydraulic Research.

T. E. Croley, F. Karim, II, and R. Chen.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 406. Price codes: A04 in paper copy, A01 in microfiche. Report No. 194, October 1976. 64 p, 15 fig, 16 tab, 12 ref, 1 append. OWRT A-054-1A(2).

Descriptors: \*Flood damage, \*Crops, \*Cities, \*Iowa, Floods, Damages, Rivers, Flood plains, Model studies, Mathematical models, Historic floods, Reservoirs, Reservoir operation, Flood flow, Flood stages, Economics, Costs, Estimated costs, \*Iowa River, \*Coralville Dam(Iowa).

Total flood damages associated with the different discharges of the Iowa river were estimated by Coralville Reservoir operation. Recognizing the limitations imposed by the inadequacy of the available data, a simple physical model was developed. Total flood damages on the Iowa river downstream of the Coralville dam were divided into two categories: crop damages and property

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

damages. Crop damages are heavily dependent upon the time of occurrence of the flood, while property damages can be considered as independent of the time of the year for all practical purposes. Because of the time-independence characteristics, property damages were estimated by using historical stage-damage relationships directly. The crop damages, which are dependent upon the time of the year, were estimated by multiplying cultivated area flooded by a unit crop damage value,  $K$  (\$/cultivated acre). The factor  $K$  may be considered, in general, as a function of depth, duration, time of the year of flood, etc. Only the variation of  $K$  with the time of the year was considered; other factors influencing  $K$  were ignored because of insufficient data. Estimates of total flood damages downstream of the Coralville dam for different discharges of the Iowa river at the dam were presented for six different periods of the year. (Sims-ISWS)  
W78-07258

**NUISANCE-ALGAE CONTROL THROUGH MECHANICAL HARVESTING.**  
California Univ., Berkeley. Sanitary Engineering Research Lab.  
For primary bibliographic entry see Field 5G.  
W78-07266

**AN ENGINEERING REPORT ON SELECTED RESERVOIR SITES IN THE BANDON AREA.**  
Oregon State Engineers Office, Salem. Watershed Planning Div.  
For primary bibliographic entry see Field 6B.  
W78-07280

**FRESHWATER RESOURCES OF THE OREGON COASTAL ZONES.**  
Oregon Water Resources Board, Salem.  
For primary bibliographic entry see Field 2L.  
W78-07281

**ROLE OF HIGHER AQUATIC VEGETATION IN THE ACCUMULATION OF ORGANIC AND BIOGENIC SUBSTANCES IN INLAND WATERS.**  
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.  
For primary bibliographic entry see Field 5C.  
W78-07294

**INDEX OF SURFACE-WATER STATIONS IN TEXAS, OCTOBER 1977.**  
Geological Survey, Austin, TX. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-07312

**WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1976.**  
Geological Survey, St. Paul, MN. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-07313

**WATER RESOURCES DATA FOR ARKANSAS, WATER YEAR 1976.**  
Geological Survey, Little Rock, AZ. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-07314

**THE SOUTH DAKOTA COOPERATIVE LAND USE EFFORT: A STATE LEVEL REMOTE SENSING DEMONSTRATION PROJECT.**  
South Dakota State Planning Bureau, Pierre; and Geological Survey, Sioux Falls, SD. EROS Data Center.  
P. A. Tessar, D. R. Hood, and W. J. Todd.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Land Use-Marine Resources, Vol I-C. Report No NASA TM X-58168, Symposium held June 9-12, 1975, Houston, Texas, p 1499-1523, September 1975, 17 fig, 12 ref.

Descriptors: \*Remote sensing, \*Aerial photography, \*Aircraft, \*Natural resources, \*South Dakota, Mapping, Water resources, Land use, Wetlands, Vegetation, Rivers, Lakes, Data collections, Project planning, Methodology, \*LANDSAT, EROS Data Center, Sioux Falls(S Dak).

Remote sensing technology can satisfy or make significant contributions toward satisfying many of the information needs of governmental natural resource planners and policy makers. Recognizing this potential, the South Dakota State Planning Bureau and the EROS Data Center together formulated the framework for an ongoing Land Use and Natural Resource Inventory and Information System Program. Statewide land use/land cover information is currently being generated from LANDSAT digital data and high altitude photography. Many applications of the system are anticipated as it evolves and data is added from more conventional sources. The paper primarily deals with the conceptualization, design, and implementation of the program. (See also W78-01589) (Woodard-USGS)  
W78-07315

**THE NATIONAL LAND USE DATA PROGRAM OF THE U.S. GEOLOGICAL SURVEY.**  
Geological Survey, Reston, VA. Land Information and Analysis Office.  
J. R. Anderson, and R. E. Witter.  
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Land Use-Marine Resources, Vol I-C. Report No NASA TM X-58168, Symposium held June 9-12, 1975, Houston, Texas, p 1609-1615, September 1975, 11 ref.

Descriptors: \*Remote sensing, \*Aerial photography, \*Aircraft, \*Mapping, \*Land use, Natural resources, Wetlands, Vegetation, Rivers, Lakes, United States, Data collections, Programs, \*Land Use Data and Analysis Program(LUDA), \*LANDSAT.

The Land Use Data and Analysis (LUDA) Program will provide a systematic and comprehensive collection and analysis of land use and land cover data on a nationwide basis. The initial nationwide collections of these data will be completed within a 5-year period. Individual land use/cover maps and their associated data will be released as they become available following compilation. Periodic revision of the data is planned. Maps will be about 1:125,000 scale showing present land use/cover at Level II of a land use/cover classification system developed by the U.S. Geological Survey in conjunction with other Federal and State agencies and other users. For each of the land use/cover maps produced at 1:125,000 scale, overlays will also be compiled showing divisions. The program will use the advanced technology at the Special Mapping Center of the U.S. Geological Survey, high altitude NASA photographs, aerial photographs acquired for the USGS Topographic Division's mapping program and LANDSAT data in complementary ways (See also W78-01589) (Woodard-USGS)  
W78-07316

**LAND USE AND ENVIRONMENTAL ASSESSMENT IN THE CENTRAL ATLANTIC REGION.**  
Geological Survey, Reston, VA. Land Information and Analysis Office.  
R. H. Alexander, K. Fitzpatrick, H. F. Lins, Jr., and H. K. McGinty, III.  
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session

Presentations, Land Use-Marine Resources, Vol I-C. Report No NASA TM X-58168, Symposium held June 9-12, 1975, Houston, Texas p 1683-1727, September 1975, 22 fig, 7 tab, 6 ref.

Descriptors: \*Remote sensing, \*Aerial photography, \*Aircraft, \*Natural resources, \*Land use, Regional analysis, Data collections, Mapping, Information exchange, Project planning, Water resources, Rivers, Lakes, Groundwater, Water quality, Vegetation, Maps, Programs, Evaluation, \*Central Atlantic States, \*LANDSAT, \*SKYLAB.

Data from high altitude aircraft, LANDSAT and SKYLAB, have been used in a comprehensive regional survey of land use and its associated environmental impact in the Central Atlantic Regional Ecological Test Site (CARETS). Each sensor system has advantages that were demonstrated by producing experimental land use maps and other data products, applying them to typical problems encountered in regional planning and environmental impact assessment, and presenting the results to prospective users for evaluation. An archival collection of imagery, maps, data summaries, and technical reports has been assembled, constituting an environmental profile of the central Atlantic region. The investigation was organized into four closely-related modules, a land use information module, an environmental impact module, a user interaction and evaluation module, and a geographic information systems module. Results revealed a heterogeneous user community with diverse information needs, tending toward the higher-resolution sensor data and the larger-scale land use maps and related information products. Among project recommendations are greater efforts toward improving compatibility of Federal, State, and local land use information programs, and greater efforts toward a broader exchange of imagery, computer tapes, and land use information. (See also W78-01589) (Woodard-USGS)  
W78-07317

**PRODUCTION OF MONOSEX WHITE AMUR FOR AQUATIC PLANT CONTROL.**  
Fish Farming Experimental Station, Stuttgart, AR. J. G. Stanley.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 911. Price codes: A05 in paper copy, A01 in microfiche. Contract Report A-76-1, Mobility and Environmental Systems Lab., U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Oct. 1976. 94 p, 16 fig, 7 tab, 53 ref, 1 append. APCP-3-73-1.

Descriptors: \*Fish hatcheries, \*Aquatic weed control, \*Costs, \*White amur, \*Monosex fish, \*Biocontrol, \*Gynogenesis, \*Sex reversal, Fish management, Fish farming, Carp, Hybrids, Androgenesis, Fish genetics, Ctenopharyngodon idella, Bibliographies, Fish stocking, Fish, Submerged plants, Methodology.

Of several methods of producing monosex white amur fish (Ctenopharyngodon idella) for aquatic weed control, a combination of gynogenesis and sex reversal in a two-stage development process tested out as the most practical. Gynogenesis, or the development of an egg after penetration by a sperm that does not contribute to inheritance, was achieved in eggs fertilized with sperm irradiated to denature DNA in chromosomes, and broods consisted entirely of females. Sex reversal, the most economical technique, unfortunately requires about five years and therefore is best utilized as a second phase following preliminary gynogenetic production. Male fish with female genotype are made by feeding androgen (male hormone) to gynogenetic young; mating sex-reversed males (female type) with normal females in ordinary hatchery operations results in all-female broods. Use of monosex amur are more economical than chemical or mechanical weed control treatment;

the 20-50 fish/acre less than 51 each be effective for total about \$50/acre. Gynogenesis. Gyn. while sex reversal. White amur of aquatic weeds. Najas, Myriophyllum, and L. sp. described, and (Lynch-Wiscor) W78-07326

**HYDRAULICS OF LANDS.**  
Florida Univ. engineering. For primary bibliographic entry see Field 7C.  
W78-07340

**WATER RESOURCES BASIN, WEST.**  
Geological Survey, Div. H. W. Young, Idaho Department of Water Information, p. 34 fig, 17 tab.

Descriptors: \*Surface water supply, Irrigation, Water yield, rates, Sedimentation, Chemical analysis, \*Weiser River.

The study area is in west-central Weiser River south of Weiser, sparsely populated agricultural, irrigation, and water is surplus in the basin and the overmentary rock and water aquifers. Weiser River has 1,835 gpm (range from 1,000 to 2,500 gpm) drawdown. of the basin near Weiser. year low flow is 19 cfs (cubic feet per second), flow was 19 cfs the station, exceeds 3 ft, flows in the occur during higher altitudes. water is generally dissolved-solids 200 mg/liter. good chemical concentrations. periods of temperature and color. the Weiser streams range from 1 to 10 miles. (Woodard-USGS)  
W78-07342

**DOWNSIDE ROUTING.**  
Geological Survey, Resources M. E. Jenn. Computer 42 p, 1 tab.

# WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

## Control Of Water On The Surface—Group 4A

the 20-50 fish/acre required can be produced for less than \$1 each, and one stocking operation may be effective for about six years. Costs therefore total about \$50/acre, or \$8/acre for each year of effectiveness. Gynogenesis costs about \$3 per fish, while sex reversal costs less than \$0.5 per fish. White amur effectively control such submersed aquatic weeds as Potamogeton, Egeria, Elodea, Najas, Myriophyllum, Hydrilla, and some filamentous algae. Costs and operation of a facility are described, and a 53-page bibliography is included. (Lynch-Wisconsin)  
W78-07326

### HYDRAULICS OF SHEET FLOW IN WETLANDS

Florida Univ., Gainesville. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 8B.  
W78-07340

### WATER RESOURCES OF THE WEISER RIVER BASIN, WEST-CENTRAL IDAHO

Geological Survey, Boise, ID. Water Resources Div.  
H. W. Young, W. A. Harenberg, and H. R. Seitz.  
Idaho Department of Water Resources, Boise.  
Water Information Bulletin No 44, May 1977. 104 p, 34 fig, 17 tab, 33 ref.

Descriptors: \*Water resources, \*Water quality, \*Surface waters, \*Groundwater, \*Idaho, Water supply, Irrigation, Potentiometric level, Aquifers, Water yield, Available water, Streamflow, Flow rates, Sediment yield, Floods, Water analysis, Chemical analysis, Maps, Hydrologic data, \*Weiser River basin (Ida), West-central Idaho.

The study area comprises about 1,600 square miles in west-central Idaho and includes the entire Weiser River basin and small areas both west and south of Weiser outside the basin. The basin is sparsely populated and the economy is chiefly agricultural. The principal use of water is for irrigation, and the largest source of readily available water is surface water. The principal aquifers are in the basalt of the Columbia River Basalt Group and the overlying Tertiary and Quaternary sedimentary rocks. Ground water occurs under artesian and water-table conditions in both types of aquifers. Well yields in the basin range from 1 to 1,835 gpm (gallons per minute). Specific capacities range from less than 0.01 to 61.2 gpm per foot of drawdown. Mean annual surface-water discharge of the basin above the gaging station, Weiser River near Weiser, is 788,000 acre-feet. The 7-day, 2-year low flow for Weiser River near Weiser is 102 cfs (cubic feet per second), and the highest peak flow was 19,900 cfs in December 1955. Flow past the station, Weiser River near Weiser, equals or exceeds 3,000 cfs 10 percent of the time. Peak flows in the tributaries at lower altitudes normally occur during January and in the tributaries at higher altitudes during April and May. Ground water is generally of good chemical quality, with dissolved-solids concentrations generally less than 200 mg/liter. Surface waters also are generally of good chemical quality, with dissolved-solids concentrations less than 150 mg/liter, except during periods of low flow in late summer when water temperatures were near 25 deg C, algal growths and coliforms bacteria were in several reaches of the Weiser River. Suspended-sediment yields from streams range from 5 to over 500 tons per square mile. (Woodard-USGS)  
W78-07342

### DOWNSTREAM-UPSTREAM RESERVOIR ROUTING

Geological Survey, Bay Saint Louis, MS. Water Resources Div.  
M. E. Jennings.  
Computer Contribution Report, September 1977. 42 p, 1 tab, 1 ref.

Descriptors: \*Reservoirs, \*Flow control, \*Flood routing, \*Computer models, \*Computer programs, Streamflow, Flow rates, Hydraulics, Hydrology, Mathematical models, Water storage, Methodology, Reservoir operation, Inflow, Discharge (Water), \*Modified Puls Method.

This program can be used to route an inflow hydrograph (downstream routing) through an uncontrolled reservoir to obtain an outflow hydrograph or by specification of a code on the parameter card, the program can be used to route an outflow hydrograph (upstream routing) thereby obtaining the inflow hydrograph. The routing, in either case, is limited to uncontrolled reservoirs with arbitrary but unique storage-outflow relationships. The method used is the modified Puls Method. (Woodard-USGS)  
W78-07344

### REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS-OKLAHOMA, 1977 WATER YEAR

Geological Survey, Little Rock, AR. Water Resources Div.  
G. L. Ducret, Jr.  
Open-file report 78-259, 1978. 25 p, 1 fig, 3 tab, 3 ref.

Descriptors: \*Streamflow, \*Discharge (Water), \*Interstate compact, \*Arkansas, \*Oklahoma, Annual, Water yield, Gaging stations, Reservoir storage, Hydrologic data, \*Arkansas River basin.

The computed annual yields for subbasins in the Arkansas River basin as defined in the Arkansas River Basin Compact, Arkansas-Oklahoma, 1972, are presented. The term "Arkansas River Basin" means all of the drainage basin of the Arkansas River and its tributaries from a point immediately below the confluence of the Grand-Neosho River with the Arkansas River near Muskogee, Okla., to a point immediately below the confluence of Lee Creek with the Arkansas River near Van Buren, Ark., together with the drainage basin of Spavinaw Creek in Arkansas, but excluding that part of the drainage basin of the Canadian River above Lake Eufaula Dam. Actual runoff from the subbasins and depletion caused by major reservoirs in the compact area also are given. Monthly, maximum, minimum, and mean discharges are included for the 14 streamflow stations used in computing annual yield. (Woodard-USGS)  
W78-07345

### UNSTEADY-STATE WATER-QUALITY MODEL

Geological Survey, Lakewood, CO. Water Resources Div.; and Geological Survey, Bay Saint Louis, MS. Water Resources Div.  
For primary bibliographic entry see Field 5B.  
W78-07348

### TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN ILLINOIS

Geological Survey, Champaign, IL. Water Resources Div.  
G. W. Curtis.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 255, Price codes: A05 in paper copy, A01 in microfiche. Water-Resources Investigations 77-117, 1977. 70 p, 16 fig, 3 tab, 10 ref.

Descriptors: \*Flood frequency, \*Flood forecasting, \*Regression analysis, \*Illinois, \*Streamflow, Flood peak, Equations, Statistical methods, Rainfall-runoff relationships, Peak discharge, Flow characteristics, Natural flow, Flood recurrence interval, Frequency curves, Unregulated streams, Basin characteristics.

A technique is presented for estimating flood magnitudes at recurrence intervals ranging from 2 to

500 years, for unregulated rural streams in Illinois, with drainage areas ranging from 0.02 to 10,000 square miles. Multiple regression analyses, using streamflow data from 241 sampling sites, were used to define the flood-frequency relationships. The independent variables drainage area, slope, rainfall intensity, and an areal factor are used in the estimating equations to determine flood peaks. Examples are given to demonstrate a step-by-step procedure in computing a 100-year flood for a site on an ungaged stream and a site on a gaged stream in Illinois. The report is oriented toward planners and designers of engineering projects such as highways, bridges, culverts, flood-control structures, and drainage systems, and toward planners responsible for planning flood-plain use and establishing flood-insurance rates. (Woodard-USGS)  
W78-07350

### FREQUENCY ANALYSIS OF ILLINOIS FLOODS USING OBSERVED AND SYNTHETIC STREAMFLOW RECORDS

Geological Survey, Champaign, IL. Water Resources Div.  
G. W. Curtis.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 350, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 77-104, 1977. 32 p, 5 fig, 10 tab, 22 ref.

Descriptors: \*Flood forecasting, \*Flood frequency, \*Regression analysis, \*Flood peak, \*Illinois, Model studies, Equations, Rainfall-runoff relationships, Streamflow, Peak discharge, Flow characteristics, Natural flow, Flood recurrence interval, Synthetic hydrology, Statistical methods, Frequency curves, Unregulated flow, Basin characteristics.

Equations, applicable Statewide, for estimating flood magnitudes having recurrence intervals ranging from 2 to 500 years for unregulated rural streams, with drainage areas ranging from 0.02 to 10,000 square miles, were derived by multiple regression analyses. A rainfall-runoff model was used in the synthesis of long-term annual peak data for each of 54 small watersheds (drainage areas less than 10.2 sq mi). Synthetic frequency curves generated from five long-term precipitation stations were combined into one synthetic curve. This synthetic curve was combined with the observed station frequency curve to define the station frequency curve. Synthetic data from the 54 small streams, observed data at 33 small streams, and observed data at 154 large streams were used in the analyses. The most significant independent variables in the regression analysis for estimating flood peaks on Illinois stream were drainage area, slope, rainfall intensity, and an areal factor. (Woodard-USGS)  
W78-07355

### FLOOD-HAZARD STUDY—100-YEAR FLOOD STAGE FOR LUCERNE LAKE, SAN BERNARDINO COUNTY, CALIFORNIA

Geological Survey, Menlo Park, CA. Water Resources Div.  
M. W. Busby.  
Open-file report 77-597, July 1977. 32 p, 13 fig, 5 tab, 6 ref.

Descriptors: \*Flood frequency, \*Playas, \*California, \*Deserts, \*Synthetic hydrology, Analytical techniques, Peak discharge, Water yield, Equations, Channel morphology, Inflow, Flood stages, Evaluation, Flood plain zoning, Land development, \*100-year flood stage, \*Lucerne Lake (Calif), San Bernardino.

A study of the flood hydrology of Lucerne Valley, Calif., was made to develop the 100-year stage for Lucerne Lake. Synthetic-hydrologic techniques were used; and the 100-year flood stage was estimated to be at an elevation of 2,849.3 feet above



## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

mean sea level. Channel dimensions were measured at 59 sites in Lucerne Valley. Drainage area-discharge relations developed from channel-geometry data for sites nearby were used to estimate the discharge at 12 additional sites where channel geometry could not be measured. In order to compute the total volume discharge into the playa, the peak discharges were converted to volumes. From the Apple Valley report (Busby, 1975) the equation formulated from the relation between peak discharge and flood volume for the deserts of California was used to compute the flood volumes for routing into Lucerne Lake. (Woodard-USGS)  
W78-07359

**SEEPAGE STUDY OF THE SEVIER VALLEY-PIUTE CANAL, SEVIER COUNTY, UTAH.**  
Geological Survey, Salt Lake City, UT. Water Resources Div.  
R. W. Cruft.  
Utah Department of Natural Resources, Salt Lake City, Division of Water Rights, Technical Publication No 58, 1977. 31 p, 3 fig, 2 tab, 1 ref.

Descriptors: \*Canal seepage, \*Utah, \*Hydrologic data, \*Water resources, \*Flow nets, Measurement, Water levels, Discharge(Water), Water temperature, Specific conductivity, Evaluation, Sevier County(Utah), \*Sevier Valley-Piute Canal.

A study of the gains or losses of the Sevier Valley-Piute Canal from near Joseph to near Aurora, Sevier County, Utah, was made to aid in water allocation for the canal system. Four sets of seepage measurements were made in 1976, and the three most representative were used in the analysis. Adjustments for fluctuations in flow in the canals were made from information obtained from water-stage recorders operated at selected locations along the canal during the time of each seepage run. The study showed a net loss of 13 cubic feet per second. During the seepage runs, an average of 198 cubic feet per second entered the canal, thus the net loss was 6.6 percent of the available water. (Woodard-USGS)  
W78-07360

**FLOODING IN BIG THOMPSON RIVER, COLORADO, TRIBUTARIES: CONTROLS ON CHANNEL EROSION AND ESTIMATES OF RECURRENT INTERVAL.**  
Colorado Univ., Boulder. Dept. of Geography; and Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.  
For primary bibliographic entry see Field 4D.  
W78-07371

**INVESTIGATION OF SNOW CONTROL SYSTEMS ON AN AVALANCHE SLOPE.**  
E. P. Isayenko, and A. B. Vasil'yev.  
Soviet Hydrology: Selected Papers, Vol. 15, No. 3, p 218-225, 1976. 9 fig, 2 tab, 10 ref. Translated from Sakh. UGMS, Sneg i laviny Sakhalina, p 103-118, 1975.

Descriptors: \*Snow, \*Avalanches, \*Snow management, Laboratory tests, On-site investigations, Snow cornice, Winds, Hazards, Mountains, Slopes, Snow cover, Snow packs, USSR, \*Sakhalin(USSR), \*Wind-tunnel tests, Snow fences, Snow control.

Snow avalanches in the mountain regions of Southern Sakhalin usually are produced by the overloading of the upper parts of leeward slopes by windblown snow from windward slopes. Fragments of large snow cornices at the crests of slopes that fall on roads or railroads present a great hazard for transportation. The impact of such a fragment on a moving train may cause derailment. The fall of a cornice on a slope frequently triggers an avalanche in Southern Sakhalin. The operation of snow-deflecting fences and snow control systems on mountain slopes has been

investigated by the Scientific Research Institute of Railroad Transportation since 1969. Systems for regulating snow deposition have been installed along railroads in several avalanche areas of Southern Sakhalin in 1971-72, with allowance for the results of simulation in wind tunnels and of anemometer surveys. The method and some results of investigations were reported. The results of our investigations showed the effectiveness of wind tunnel simulation for the study of snow control on mountain slopes. To allow for factors that are not simulated but have an effect on snow deposition on slopes, one must perform anemometer and snow surveys in the field. An analysis of the wind tunnel and field investigation indicated that snow control systems can be used successfully in avalanche areas where blowing snow has a strong effect on avalanche formation. (Sims-ISWS)  
W78-07375

**WATER RESOURCES AND CLIMATIC CHANGE.**  
Department of the Environment, Reading (England). Water Data Unit.  
For primary bibliographic entry see Field 2A.  
W78-07380

**FIRST FOUR DECADES OF THE HYDRAULICS DIVISION.**  
Iowa Univ., Iowa City.  
For primary bibliographic entry see Field 2A.  
W78-07382

**GENERATION OF UNGAGED STREAMFLOW DATA.**  
Saskatchewan Univ., Regina. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2A.  
W78-07384

**A VARIATIONAL INEQUALITY METHOD APPLIED TO FREE SURFACE SEEPAGE FROM A TRIANGULAR DITCH.**  
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.  
J. C. Bruch, Jr., and J. M. Sloss.  
Water Resources Research, Vol. 14, No. 1, p 119-124, February 1978. 2 fig, 2 tab, 12 ref.

Descriptors: \*Mathematical models, \*Seepage, \*Ditches, Drains, Equations, Groundwater movement, Numerical analysis, Free surfaces, Soils, Depth, Successive overrelaxation method, Triangular ditches, Analytical solution.

Two-dimensional seepage from a single triangular channel into permeable soil underlain at a finite depth by a drain was solved by reducing the problem to a variational inequality. The results obtained consist of the location of the free surface, and thus, the shape of the seepage region, the velocity potential and stream function at a series of mesh points, and the seepage flow rate. The successive overrelaxation method with projection was used to solve the numerical problem. The numerical results compared very favorably with the analytical solution to the same problem. (Visocky-ISWS)  
W78-07390

**SOME PROPERTIES OF VARIANCE REDUCTION TECHNIQUES WHERE HYDROLOGICAL EXTREMES ARE ESTIMATED BY MONTE CARLO SIMULATION.**  
Institute of Hydrology, Wallingford (England).  
For primary bibliographic entry see Field 2E.  
W78-07391

**AQUATIC USE PATTERN FOR DIQUAT FOR CONTROL OF EGERIA AND HYDRILLA.**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.

For primary bibliographic entry see Field 5G.  
W78-07399

**EFFICACY AND RESIDUES OF DIQUAT APPLIED FOR CONTROL OF EGERIA AND HYDRILLA.**  
Agricultural Research Service, Fort Lauderdale, FL. Southern Region.  
For primary bibliographic entry see Field 5G.  
W78-07400

**GREENHOUSE STUDIES OF THE GROWTH AND REPRODUCTION OF EGERIA Densa.**  
University of Southwestern Louisiana. Lafayette. J. A. Foret, J. R. Barry, S. J. Langlinais, S. L. Solymosy, and D. P. Vioror.  
In: Appendix D. Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, Technical Report No. 13, Army Corps of Engineers, Aquatic Plant Control Program, September 1976. 40 p, 1 fig, 29 tab.

Descriptors: \*Egeria densa, \*Aquatic weed control, \*Plant growth, \*Herbicides, \*Chemcontrol, Reproduction, Louisiana, Diquat, Fenac, Copper, Black Lake(LA), Lake Martin(LA), Koline, K-lox, Lakes, Rate of application.

Laboratory and field investigations of growth and reproduction of Egeria densa and its response to herbicides indicate the plant produces only male flowers in Louisiana and reproduces vegetatively only from stem tips. The most efficient chemicals for control are diquat plus koline or K-lox. Annual treatment is necessary to maintain control. Chemical control of egeria is expensive, but must be used where measures such as drawdown or biocontrol are not practical. Recommended application rates are 4 lb ai/A diquat, 6.4 lb/A copper ion from koline, or 2 lb ai/A diquat plus 3.2 lb/A copper ion from koline or K-lox. Large-scale field testing was carried out in 1973 in two Louisiana lakes, Lake Martin near Lafayette and Black Lake near Natchitoches. Small-scale field testing also was conducted in Lake Martin, a shallow lake 6-8 ft deep with dense stands of egeria and lesser infestations of Ceratophyllum and Ultricularia. Four treatments effectively controlled egeria in the small-scale testing: fenac at 10 lb ai, fenac plus copper at 10 lb ai + 2.7 lb ai, diquat plus copper at 1.36 lb ai + 2.7 lb ai, and diquat + copper at 2.7 lb ai + 2.7 lb ai. Addition of copper to fenac did not enhance its effectiveness; all four treatments were equally effective. Treatments with 2,4-D were unsuccessful. (See also W78-07399) (Lynch-Wisconsin)  
W78-07401

**AQUATIC WEED CONTROL IN SMALL RESERVOIRS WITH DIQUAT.**  
Agricultural Research Service, Davis, CA.  
For primary bibliographic entry see Field 5G.  
W78-07402

**FINAL ENVIRONMENTAL STATEMENT FOR WALKER DAM IMPOUNDMENT, AQUATIC PLANT CONTROL PROJECT, NEW KENT COUNTY, VIRGINIA.**  
Army Engineer District, Norfolk, VA.  
For primary bibliographic entry see Field 6G.  
W78-07403

**MODERNIZATION AND IMPROVEMENT OF NEW YORK'S RIPARIAN LAW.**  
New York State Legislature, Albany.  
For primary bibliographic entry see Field 6E.  
W78-07410

**DISTRIBUTION, GROWTH, AND PHOSPHORUS RELATIONSHIPS OF MYRIOPHYLLUM HETEROPHYLLUM**

MICHX. IN HAMPSHIRE New Hamps and Plant Pa For primary W78-07482

FORCED P VOIR, Salford Uni ing. For primary W78-07489

INVESTIGA IN CLOSE BASIS OF ELEMENT For primary W78-07500

DYNAMIC For primary W78-07501

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# WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

## Control Of Water On The Surface—Group 4A

**MICHX. IN LAKE WINNIPESAUKEE, NEW HAMPSHIRE,**  
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.  
For primary bibliographic entry see Field 5C.  
W78-07482

**FORCED PLUMES IN A STRATIFIED RESERVOIR,**  
Salford Univ. (England). Dept. of Civil Engineering.  
For primary bibliographic entry see Field 8B.  
W78-07489

**INVESTIGATION OF LEVEL FLUCTUATIONS IN CLOSED BODIES OF WATER ON THE BASIS OF STOCHASTIC MODELS OF THE ELEMENTS OF THE HYDROLOGIC BUDGET,**  
For primary bibliographic entry see Field 2E.  
W78-07500

**DYNAMICS OF LAKE ONEGA WATERS,**  
For primary bibliographic entry see Field 2H.  
W78-07501

**COMPUTATION OF THE PATTERN OF CURRENTS IN RIVERS AND NONSTRATIFIED RESERVOIRS,**  
For primary bibliographic entry see Field 2E.  
W78-07502

**VARIATION OF DRAINAGE DENSITY IN A SMALL BRITISH COLUMBIA WATERSHED,**  
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Geography.  
For primary bibliographic entry see Field 4D.  
W78-07505

**FLOODPLAIN DELINEATION USING LANDSAT-1 DATA,**  
Pennsylvania State Univ., University Park. Space Science and Engineering Lab.  
D. L. Henninger, M. L. Stauffer, G. W. Petersen, and G. J. McMurry.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 280. Price codes: A04 in paper copy, A01 in microfiche. ORSER-SSEL Technical Report 20-75, December 1975. 63 p, 15 fig, 4 tab, 29 ref.

Descriptors: \*Flood plains, \*Geomorphology, \*Aerial photography, \*Mapping, Computer models, Soil types, Vegetation, Topography, Remote sensing, Terrain analysis, Model studies, \*Susquehanna River, \*LANDSAT-1.

This investigation was designed to determine if floodplain boundaries could be delineated by applying automatic computer processing techniques to satellite-collected (LANDSAT-1) multispectral scanner data. The criteria used to distinguish floodplain from non-floodplain areas were natural indicators, such as differences in vegetation, moisture, and soils. The areas studied included a forested site as well as a predominately agricultural and developed site. A continuous floodplain boundary was drawn on the basis of interpretation of the computer classification of selected LANDSAT-1 digital MSS data. The floodplain correlated well within the agricultural and developed portion of the study area. Within the forested portion, correlation was not as satisfactory, consistently overestimating the floodplain. (Lardner-ISWS)  
W78-07510

**ENVIRONMENTAL CONSIDERATIONS RELATING TO OPERATION AND MAINTENANCE OF THE TEXAS GULF INTRACOASTAL WATERWAY,**  
Texas A and M Univ., College Station. Ocean Engineering Program.  
For primary bibliographic entry see Field 2L.

W78-07538

**DERIVATION OF INITIAL SOIL MOISTURE ACCOUNTING PARAMETERS FROM SOIL PROPERTIES FOR THE NATIONAL WEATHER SERVICE RIVER FORECAST SYSTEM,**  
National Weather Service, Silver Spring, MD. Office of Hydrology.  
For primary bibliographic entry see Field 2G.  
W78-07551

**ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (EXECUTIVE SUMMARY),**  
Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07563

**ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART B: CALIFORNIA (EXECUTIVE SUMMARY),**  
Jones and Stokes Associates, Inc., Sacramento, CA.  
For primary bibliographic entry see Field 6G.  
W78-07564

**ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH WILDLIFE, PART B: CALIFORNIA (FINAL REPORT),**  
Jones and Stokes Associates, Inc., Sacramento, CA.  
For primary bibliographic entry see Field 6G.  
W78-07565

**ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART B: CALIFORNIA (CASE STUDIES),**  
Jones and Stokes Associates, Inc., Sacramento, CA.  
For primary bibliographic entry see Field 6G.  
W78-07566

**ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (FINAL REPORT),**  
Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07567

**ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (ROCKY MOUNTAIN REGION CASE STUDIES),**  
Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07568

**ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (PACIFIC NORTHWEST REGION CASE STUDIES),**  
Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07569

**ECONOMICS OF CONTROLLING IRRIGATION RETURN FLOW IN THE MESILLA VALLEY, NEW MEXICO,**  
New Mexico State Univ., University Park.  
For primary bibliographic entry see Field 5G.

W78-07635

**AGRICULTURAL DRAINAGE PROBLEMS OF THE SAN JOAQUIN VALLEY,**  
Bureau of Reclamation, Sacramento, CA. Mid-Pacific Regional Office.  
E. P. Price.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 283-287, May 16-19, 1977. 2 fig, 1 tab.

Descriptors: Agriculture, \*California, Drainage districts, \*Drainage practices, Drainage, \*San Joaquin Valley (Calif).

A brief description of the physical setting of the San Joaquin Valley and the drainage problems anticipated are presented. Estimates are preliminary and subject to revision as studies continue. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07636

**LOCAL SOLUTIONS TO DRAINAGE PROBLEMS,**  
Westlands Water District, Fresno, CA.  
W. R. Johnstone.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 293-295, May 16-19, 1977.

Descriptors: Saline water, Salinity, \*Return flow, Drainage water.

Throughout the San Joaquin Valley the installation of on-farm tile systems can intercept and collect saline subsurface drainage water and thereby reduce or eliminate the damage from high water tables. Five subareas in the San Joaquin and Tulare Lake Basins of the San Joaquin and Tulare Lake Basins of the San Joaquin Valley have individually developed local solutions for disposing of saline subsurface drainage water collected within the subareas. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07638

**A VALLEYWIDE SOLUTION--THE INTERAGENCY DRAINAGE PROGRAM,**  
San Joaquin Valley Interagency Drainage Program, Fresno, CA.  
L. A. Beck.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 297-298, May 16-19, 1977.

Descriptors: \*Drainage practices, \*California, \*Return flow, \*San Joaquin Valley (Calif).

The San Joaquin Valley Interagency Drainage Program (IDP) is an action-oriented program with objectives including: (1) coordination of the on-going drainage water management activities of the cooperating agencies (USBR, SWRCB, and DWR); (2) development of alternative plans for managing the drainage waters; (3) determination of potential uses for drainage waters; (4) development of a recommended plan for managing drainage waters; (5) recommending ways to finance drainage facilities. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07639

**WELLTON-MOHAWK ON-FARM SYSTEMS IMPROVEMENT PROGRAM,**  
Soil Conservation Service, Phoenix, AZ.  
For primary bibliographic entry see Field 3C.  
W78-07645

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

**DEVELOPMENT OF BEST MANAGEMENT PRACTICES FOR SALINITY CONTROL IN GRAND VALLEY.**  
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07650

**IMPROVEMENTS FOR LITTLE RIVER INLET, SOUTH CAROLINA; HYDRAULIC MODEL INVESTIGATION.**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
For primary bibliographic entry see Field 8B.  
W78-07671

**PHYSICAL HYDRAULIC MODELS: ASSESSMENT OF PREDICTIVE CAPABILITIES; REPORT 2, MOVABLE-BED MODEL OF GALVESTON HARBOR ENTRANCE.**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
For primary bibliographic entry see Field 8B.  
W78-07672

**PROBLEM IDENTIFICATION AND RANKING, AN ASSESSMENT OF A RIVER BASIN PLANNING PROCESS.**  
Illinois Univ., at Urbana-Champaign. Dept. of Urban and Regional Planning.  
For primary bibliographic entry see Field 6B.  
W78-07687

**METHODS FOR CALCULATING MAXIMUM FLOOD DISCHARGES FOR NATURAL WATERCOURSES AND URBAN AREAS IN THE U.S.S.R.**  
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).  
For primary bibliographic entry see Field 2A.  
W78-07697

### 4B. Groundwater Management

**RELATIONSHIP BETWEEN GROUNDWATER RESOURCES AND ENERGY PRODUCTION IN SOUTHWESTERN MISSOURI.**  
Missouri Univ., Columbia. Dept. of Geology.  
For primary bibliographic entry see Field 2K.  
W78-07702

**WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1976.**  
Geological Survey, St. Paul, MN. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-07713

**WATER RESOURCES DATA FOR ARKANSAS, WATER YEAR 1976.**  
Geological Survey, Little Rock, AZ. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-07714

**DATA REPORT--MARSH/POND SYSTEM.**  
Brookhaven National Lab., Upton, NY. Dept. of Applied Science.  
For primary bibliographic entry see Field 5D.  
W78-07738

**WATER RESOURCES OF THE WEISER RIVER BASIN, WEST-CENTRAL IDAHO.**  
Geological Survey, Boise, ID. Water Resources Div.  
For primary bibliographic entry see Field 4A.  
W78-07742

**AVAILABILITY AND QUALITY OF GROUND WATER IN THE DRAIN-YONCALLA AREA, DOUGLAS COUNTY, OREGON.**  
Geological Survey, Portland, OR. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-07747

**PRELIMINARY DIGITAL MODEL OF THE ARIKAREE AQUIFER IN THE SWEETWATER RIVER BASIN, CENTRAL WYOMING.**  
Geological Survey, Cheyenne, WY. Water Resources Div.  
For primary bibliographic entry see Field 2F.  
W78-07751

**DRILLING, CONSTRUCTION, AND TESTING OF WATER-SUPPLY WELLS 21 AND 22, WHITE SANDS MISSILE RANGE, DONA ANA COUNTY, NEW MEXICO.**  
Geological Survey, Albuquerque, NM. Water Resources Div.  
For primary bibliographic entry see Field 8B.  
W78-07752

**THE USE OF GALERKIN FINITE-ELEMENT METHODS TO SOLVE MASS-TRANSPORT EQUATIONS.**  
Geological Survey, Denver, CO. Water Resources Div.  
For primary bibliographic entry see Field 5B.  
W78-07754

**WATER-LEVEL CHANGES IN WELLS ALONG THE WEST SIDE OF THE CEDAR CREEK ANTICLINE, SOUTHEASTERN MONTANA.**  
Geological Survey, Helena, MT. Water Resources Div.  
D. L. Coffin, T. E. Reed, and S. D. Ayers.  
Water-Resources Investigations 77-93, December 1977. 11 p, 5 fig, 4 plates, 1 tab, 4 ref.

Descriptors: \*Groundwater resources, \*Water level fluctuations, \*Water wells, \*Aquifer characteristics, \*Montana, Pumping, Drawdown, Groundwater recharge, Hydrogeology, Water users, Oil industry, Domestic water, Stock water, Aquifer management, \*Cedar Creek anticline, Southeastern Montana.

Water levels have been measured periodically in wells along the west side of the Cedar Creek anticline in southeastern Montana since 1962-64. The measurements show the response of the Fox Hills-Hell Creek aquifer of Late Cretaceous age to withdrawals for domestic, stock, and industrial uses. Water levels were as much as 109 feet lower in 1975 than they were in 1962-64. During the same period water levels lowered by 10 feet under about 400 square miles. From 1962-64 to 1969 water levels declined by as much as 133 feet. From 1969 to 1975 water levels rose as much as 46 feet near the outcrop of the aquifer and lowered 10 feet or more beneath about 100 square miles. Decreases in the rate of pumping from industrial wells near the outcrop have caused the water-level rise. Withdrawals from domestic and stock wells have remained the same or increased during the last 14 years and have contributed to water-level declines in areas west of the aquifer's outcrop. (Woodard-USGS)  
W78-07757

**DESCRIPTION OF WELLS AT BEALE AIR FORCE BASE AND VICINITY, CALIFORNIA.**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
G. L. Rockwell.  
Open-file report 78-10, January 1978. 45 p, 3 fig, 23 maps, 2 tab.

Descriptors: \*Groundwater resources, \*Water wells, \*Water levels, \*Aquifer characteristics,

\*California. Water supply. Water utilization, Well data, Data collections, \*Beale Air Force Base(Calif). Sacramento Valley.

The study area occupies approximately 168 square miles of the Sacramento Valley, Calif. The area boundary is the Yuba River in the north, the Feather River in the west, the Bear River in the south, and the Sierra Nevada foothills in the east. Between December 1976 and March 1977, 640 wells were canvassed and 274 water levels were measured at Beale Air Force Base and vicinity. Thirty-six water levels measured in March and April 1976 also are included in this report. Descriptive data for water wells accompany the water-level table. Well locations are shown on maps. (Woodard-USGS)  
W78-07758

**ARTIFICIAL GROUND-WATER RECHARGE WITH CAPILLARITY.**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
N. V. Ortiz, H. R. Duke, D. K. Sunada, and D. B. McWhorter.  
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 104, No 1R1, Proceedings paper 13627, March 1978. 11 fig, 1 tab, 21 ref.

Descriptors: \*Groundwater recharge, \*Capillary action, \*Artificial recharge, \*Numerical analysis, \*Model studies, Water table, Porous media, Pores, Hydraulic conductivity, Depth, Pit recharge, Bubbles, Percolating water, Unsteady flow, \*Capillary flow, \*Capillary zone, \*Groundwater mounds, Bubbling pressure, Pore-size distribution index.

The effect of capillarity on the transient response of the water table to recharge was evaluated by a numerical and a porous media model. The numerical model was developed to simulate the growth and spread of groundwater mounds, taking into consideration the flow and storage in the capillary regions. The contribution from the capillary region was described analytically in terms of recharge rates and the measureable soil properties of bubbling pressure, pore-size distribution index, and hydraulic conductivity. The numerical model was verified by comparing its predictions for various flow conditions with the result obtained from the porous media model. The effects of bubbling-pressure head, pore-size distribution index, initial saturated depth, depth to water table, and recharge rate on the predicted mound height were determined. It was shown that the effect of the capillary region significantly influences the growth and spread of groundwater mounds. (Visocky-ISWS)  
W78-07765

**HYDROGEOLOGY OF METROPOLITAN CHRISTCHURCH.**  
New Zealand Geological Survey, Christchurch.  
D. D. Wilson.  
Journal of Hydrology (New Zealand), Vol. 15, No. 2, p 101-120, 1976. 9 fig, 1 tab, 6 ref.

Descriptors: \*Groundwater potential, \*Hydrogeology, \*Cities, Groundwater resources, Groundwater recharge, Water yield, Permeability, Water quality, Hydrology, Saline water intrusion, Groundwater reservoir, Subsidence, Foreign countries, Foreign research, \*New Zealand, \*Christchurch(New Zealand), Groundwater sources.

The city of Christchurch and its neighboring boroughs are built on a foundation of interbedded terrestrial gravels and fine-grained marine and estuarine sediments. The gravels are aggradational deposits derived from the Waimakariri River, the larger part during periods of glacial low sea level. The finer sediments-sands, silts, and peat - have been deposited in estuaries and shallow transgressing seas during warmer periods. The gravels contain high-yielding aquifers and the interbedded



finer beds, though heterogeneous, are essentially of low permeability, confining water under pressure in the gravels. Water supplies for the metropolitan area depend entirely on groundwater, and it is important that the resource should be harvested carefully. It was suggested that: (1) the area at present uses about one-third of its annual average recharge, a high proportion of which derives from the Waimakariri River; (2) there is, so far, no evidence of long-term permanent decline of water levels and pressure levels, despite short-term decline following periods of heavy use; (3) water quality in the artesian zone is protected from surface contamination or pollution by the filtering effect of fine-grained sediments of Christchurch Formation and by differential pressures that increase with depth; (4) salt water intrusion is a possibility that cannot be ignored, though there is no sign of its occurrence so far; and (5) damaging differential subsidence may occur in Christchurch if groundwater pressures are grossly lowered by abstraction. (Lee-ISWS) W78-07368

**IMPACT OF A POWER PLANT ON THE GROUND-WATER SYSTEM OF A WETLAND,** Wisconsin Univ.-Madison. Dept. of Geology and Geophysics. For primary bibliographic entry see Field 6G. W78-07377

**FLOW TO A NONPENETRATING WELL IN A LEAKY ARTESIAN AQUIFER WITH VARIABLE DISCHARGE,** Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Engineering. For primary bibliographic entry see Field 2F. W78-07378

**GROUNDWATER RECHARGE AND COASTAL DISCHARGE FOR THE NORTHWEST COAST OF THE ISLAND OF HAWAII: A COMPUTERIZED WATER BUDGET APPROACH,** Hawaii Univ., Honolulu. Water Resources Research Center. For primary bibliographic entry see Field 2F. W78-07394

**HANDBOOK-INDEX OF HAWAII GROUND-WATER AND RESOURCES DATA, EXTRACTED FROM REPORTS OF THE WATER RESOURCES RESEARCH CENTER, UNIVERSITY OF HAWAII, VOLUME I,** Hawaii Univ., Honolulu. Water Resources Research Center. For primary bibliographic entry see Field 7C. W78-07395

**ECONOMIC IMPACT OF WATER QUALITY ON RIVER BASIN MANAGEMENT,** California Univ., Davis. Dept. of Civil Engineering. For primary bibliographic entry see Field 5G. W78-07396

**TRAVEL OF MICROORGANISMS FROM A SEPTIC TILE,** ADI Ltd., Fredericton (New England). For primary bibliographic entry see Field 5B. W78-07469

**MONITORING IN THE ZONE OF AERATION,** SCS Engineers, Long Beach, CA. For primary bibliographic entry see Field 5A. W78-07470

**TWO-DIMENSIONAL PLUME IN UNIFORM GROUND-WATER FLOW,** Massachusetts Inst. of Tech. Cambridge. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5B. W78-07490

**NONPOINT NITRATE CONTAMINATION OF GROUND WATER IN MERRICK COUNTY, NEBRASKA,** Nebraska Univ., Lincoln. Div. of Natural Resources, Conservation and Survey. For primary bibliographic entry see Field 5B. W78-07506

**NATURAL SEWAGE RECYCLING SYSTEMS** Brookhaven Nation Lab., Upton, NY. Dept. of Applied Science. For primary bibliographic entry see Field 5D. W78-07515

**REUSE OF MUNICIPAL WASTEWATER FOR GROUNDWATER RECHARGE,** SCS Engineers, Inc., Long Beach, CA. For primary bibliographic entry see Field 5D. W78-07570

**NUTRIENT, BACTERIAL, AND VIRUS CONTROL AS RELATED TO GROUND WATER CONTAMINATION,** Robert S. Kerr Environmental Research Lab., Ada, OK. For primary bibliographic entry see Field 5B. W78-07571

**HOT DRY ROCK GEOTHERMAL ENERGY DEVELOPMENT PROJECT: ANNUAL REPORT, FISCAL YEAR 1977,** Los Alamos Scientific Lab., NM. For primary bibliographic entry see Field 8B. W78-07572

**STATE AGENCIES AND OFFICIALS RESPONSIBLE FOR WATER WELL INDUSTRY CODES AND LICENSING,** For primary bibliographic entry see Field 6E. W78-07573

**WATER WELL INDUSTRY CODES AND LICENSING,** For primary bibliographic entry see Field 6E. W78-07574

**A CORING AND SQUEEZING TECHNIQUE FOR THE DETAILED STUDY OF SUBSURFACE WATER CHEMISTRY,** Queen's Univ., Kingston (Ontario). Dept. of Geological Sciences. For primary bibliographic entry see Field 2K. W78-07575

**WELL FIELD MANAGEMENT,** Moody and Associates, Meadville, PA. C. L. Simpson. Journal of the American Water Works Association, Vol. 70, No. 3, p 151-152, March, 1978.

Descriptors: \*Well field management, Water wells, Aquifers, Pumps, Pumping, Observation wells, Water supply, Monitoring, Costs, Failures, Specific capacity.

A workable well-field management program should provide for economical and efficient operations by minimizing required pumping lifts, downtime for each well, well rehabilitation frequency, well replacement frequency, and emergency service calls. The program must also be designed to assist water-plant personnel in utilizing their ground water supplies without unduly confusing these people. In setting up a program the size, shape, characteristics, and mode of recharge of the aquifer in question must be ascertained as a

first step. Once these factors are known, an observation well can be designed as an overpumpage warning system. The condition of individual well should be checked on a regular basis by comparing present specific capacities with the original specific capacity at the time of the well's construction. All applicable data should be compiled for the well pumps, including performance curves, serial numbers, and settings. (Eberle-NWWA) W78-07577

**GROUNDWATER LAW: THE RIPARIAN PROBLEM,** For primary bibliographic entry see Field 6E. W78-07578

**HOW TO MEET WELL PROJECT GOALS: PART I,** F. H. Klaer, Jr. Water and Sewage Works, Vol. 125, No. 5, p 84-87, May, 1978, 2 fig, 1 tab.

Descriptors: \*Project planning, \*Water wells, \*Ranney wells, \*Geologic investigations, Water supply, Water resources development, Evaluation, Aquifers, On-site investigations.

The investigation and study of local ground water conditions prior to a major water supply development project is actually a form of risk insurance to minimize the possibility of failure. The larger the proposed project, the more important the studies prior to construction become. There is, of course, a practical limit to the time and expense of preliminary studies that can be justified. In recent years, experience has shown the costs of such studies may run from about 5 to 25 percent of the total water development cost. Two case studies of municipal water systems utilizing Ranney collectors are presented as examples of successful ground water projects made possible by detailed site evaluation before construction. Case 1 (Wisconsin Rapids, WI) involves three Ranney wells constructed in 1953; the wells are still adequate for the present average daily use of 2.6 MGD in that community. Case report 2 discusses the six-collector system at the Wabash River Ordinance Works (Newport, IN), which produced 88.7 MGD on its peak day in 1943. (Eberle-NWWA) W78-07581

**NWWA'S MOST REQUESTED STATISTICS,** National Water Well Association, Worthington, OH. For primary bibliographic entry see Field 8A. W78-07582

**WESTERN KANSAS FACES DECLINING WATER TABLE,** Johnson Drillers Journal, Vol. 50, No. 2, p 8-9, March-April, 1978, 2 fig.

Descriptors: \*Water table, \*Kansas, \*Irrigation effects, Groundwater, \*Ogallala aquifer, Water conservation, Irrigation wells, Water management (Applied).

The Governor's Task Force on Kansas Water Resources recently completed eight months of discussions and hearings preparatory to presentation of a report to the Kansas legislature. The group's recommendations reflect two significant concepts—that the Kansas Water Resources Board should have the lead responsibility for reviewing the purpose and funding of the State's water resource programs, and that water management responsibility should be retained by local units of government. The basic need in the state is to prolong water availability via irrigation scheduling, tailwater recovery, well spacing, and artificial recharge. New definitions of "reasonable use" of irrigation water appear likely in view of significant improvements in irrigation technology, however, no basic change in the Kansas Water Appropriation

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4B—Groundwater Management

tion Doctrine is recommended at this time. Kansas has been reported to have 20,000 irrigation wells, average 8 inch diameter, average 225 feet deep, serving 3,157,000 acres. (Herber-NWWA) W78-07583

#### WATER WELL SAMPLES MUST BE COLLECTED WITH CARE.

For primary bibliographic entry see Field 5A. W78-07584

**GROUNDWATER TRACING WITH POST SAMPLING ACTIVATION ANALYSIS USING BROMIDE AND IODIDE IONS INJECTED SIMULTANEOUSLY INTO A SHALLOW-WELL SYSTEM.** Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 5B. W78-07683

#### 4C. Effects On Water Of Man's Non-Water Activities

**PLANNING GUIDELINES FOR RESIDENTIAL AND PATH DEVELOPMENT IN MICHIGAN'S SAND DUNES AND WETLANDS.** Mann (Roy) Associates, Inc., Cambridge, MA. For primary bibliographic entry see Field 4A. W78-07227

**EFFECT OF THE SMALL WATERSHED PROGRAM ON MAJOR USES OF LAND: EXAMINATION OF 60 PROJECTS IN THE SOUTHEAST, MISSISSIPPI DELTA, AND MISSOURI RIVER TRIBUTARIES REGIONS.** Economics, Statistics, and Cooperative Service, Washington, DC. Natural Resource Economics Div. For primary bibliographic entry see Field 4D. W78-07330

**URBAN RUNOFF POLLUTION CONTROL--STATE-OF-THE-ART.** Meta Systems Inc., Cambridge, MA. For primary bibliographic entry see Field 5G. W78-07335

**TRANSFORMATION OF THE HYDROLOGIC BUDGET OF THE MOSCOW CITY AREA.** M. I. L'vovich, and G. M. Chernogayeva. Soviet Hydrology: Selected Papers, Vol. 15, No. 3, p 244-249, 1976. 3 tab, 9 ref. Translated from Izvestiya Akademii Nauk SSSR, Seria Geograficheskaya, No. 3, p 52-60, 1976.

Descriptors: \*Hydrologic budget, \*Cities, \*Urbanization, \*Urban runoff, Rivers, Runoff, Water quality, Water pollution, Sewage, Sediments, Snow, Melt water, Salts, Deicers, Land use, Discharge(Water), Precipitation(Atmospheric), Rainfall, Groundwater recharge, Hydrology, Urban hydrology, \*USSR, \*Moscow(USSR).

The reasons for the changes in the hydrologic budget of a city and the effect of the city on the water resources in neighboring areas were investigated. The conditions of formation of the hydrologic budget of an urban area during the warm and cold periods of the year were analyzed taking Moscow as an example. A method was proposed for computing the hydrologic budget of an urban area. (Sims-ISWS) W78-07376

**IMPACT OF A POWER PLANT ON THE GROUND-WATER SYSTEM OF A WETLAND.** Wisconsin Univ.-Madison. Dept. of Geology and Geophysics. For primary bibliographic entry see Field 6G. W78-07377

**SALT LOADING IN DISTURBED WATERSHED-FIELD STUDY.** Golder and Associates, Seattle, WA. For primary bibliographic entry see Field 5B. W78-07484

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH: INTERNATIONAL SUMMARY.** American Society of Civil Engineers, New York. For primary bibliographic entry see Field 2A. W78-07689

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN INDIA.** Indian Inst. of Tech., Kanpur; and Indian Agricultural Research Inst., New Delhi. For primary bibliographic entry see Field 2A. W78-07690

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN NORWAY.** Norges Vassdrags- og Elektrisitetsvesen, Oslo. Hydrological Div. For primary bibliographic entry see Field 2A. W78-07693

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN FRANCE.** Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathematique. For primary bibliographic entry see Field 2A. W78-07694

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN SWEDEN.** Lund Inst. of Tech. (Sweden); and Dept. of Water Resources Engineering. For primary bibliographic entry see Field 2A. W78-07695

**URBAN HYDROLOGY STUDIES AND MATHEMATICAL MODELING IN THE FEDERAL REPUBLIC OF GERMANY.** Landesanstalt fuer Wasser und Abfall Nordrhein-Westfalen, Dusseldorf (West Germany). For primary bibliographic entry see Field 2A. W78-07696

#### 4D. Watershed Protection

**AN ANALYTICAL EVALUATION OF THE UTILIZATION AND MANAGEMENT OF WATER RESOURCES IN THE LAKE METIGOSHE WATERSHED, NORTH DAKOTA.** North Dakota State Univ., Fargo. Dept. of Zoology. For primary bibliographic entry see Field 5C. W78-07209

**EFFECT OF THE SMALL WATERSHED PROGRAM ON MAJOR USES OF LAND: EXAMINATION OF 60 PROJECTS IN THE SOUTHEAST, MISSISSIPPI DELTA, AND MISSOURI RIVER TRIBUTARIES REGIONS.** Economics, Statistics, and Cooperative Service, Washington, DC. Natural Resource Economics Div. C. D. Mattson. Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 040,

Price codes: A04 in paper copy, A01 in microfiche. USDA Agricultural Economic Report No. 279, February 1975. 58 p. 7 fig, 29 tab, 7 ref. 1 append.

Descriptors: \*Land use, \*Small Watershed Program, \*Small watersheds, \*Flood control, \*Soil erosion, \*Planning, \*Non-structural alternatives, Crop production, Mississippi River, Deltas, Missouri River, Tributaries, Southeast U.S., River basins, Flood plains, Drainage, Forecasting, Aerial photography, Irrigation, Watersheds(Basins), Rivers.

The Small Watershed Program, authorized by the Watershed Protection and Flood Prevention Act of 1954 (PL 83-566), was targeted at protection in headwaters areas and flooding and related problems of small streams, and is restricted to watersheds of 250,000 acres or less. The purpose of this study was to determine the land use changes associated with projects in three regions of the country from 1955-70; 10 completed projects were compared with 10 new projects in each region. Aerial photographs taken at the beginning and end of projects were compared and changes recorded for eight land uses: cropland, grassland, idle-transitional, forest, urban, rural-urban, miscellaneous, and reservoirs. The regions were: (1) the Southeast, (2) Mississippi River delta, and (3) Missouri River tributaries. Projections of land use changes on new projects rely heavily on stated intentions of farmers, land use capability, and soil productivity. Cropland retirement on upland portions of watersheds was more rapid on completed projects than on new ones in the Southeast and Mississippi delta. Cropland expansion did not occur in the Southeast; in the Mississippi region expansion on protected bottomlands of completed projects was well ahead of planned projects. No significant changes in cropland use were observed in the Missouri River region on completed projects, but increases in soil-conservation practices were noted. (Lynch-Wisconsin) W78-07330

**RAINFALL AND RUNOFF DATA FROM SMALL BASINS IN WYOMING.** Geological Survey, Cheyenne, WY. Water Resources Div. For primary bibliographic entry see Field 7C. W78-07349

**EFFECTS OF WETTING AGENTS ON WATER INFILTRATION INTO WATER-REPELLENT COAL MINE SPOILS.** Texas A and M Univ., El Paso. Research Center. For primary bibliographic entry see Field 5G. W78-07370

**FLOODING IN BIG THOMPSON RIVER, COLORADO, TRIBUTARIES: CONTROLS ON CHANNEL EROSION AND ESTIMATES OF RECURRENT INTERVAL.** Colorado Univ., Boulder. Dept. of Geography; and Colorado Univ., Boulder. Inst. of Arctic and Alpine Research. J. D. Balog. Geology, Vol. 6, No. 4, p 200-204, April 1978. 3 fig. 2 tab, 27 ref. NASA NGL-06-003-200.

Descriptors: \*Flash floods, \*Disasters, \*Geomorphology, \*Channel erosion, \*Colorado, Sediment yield, Erosion, Precipitation(Atmospheric), Excessive precipitation, Watersheds(Basins), Flooding, On-site investigations, \*Big Thompson River(Colo).

Channel erosion in tributaries of Colorado's Big Thompson River was studied following the 1976 flash flood. In two catchments, no measurable erosion occurred. Erosion in other catchments was intense (maximum observed sediment yield = 308 cu m/ha). Relationships between 'total' storm precipitation (P) and sediment yield give values for the maximum potential sediment yield at a given

storm magnitude when P = 140 mm. Quantitative estimates of erosion are needed to evaluate geomorphic values were used in the 1976 study. The possibility that intervals may (Humphreys-W78-07371)

**SCOUR AND EPHEMERAL MISSOURI RIVER.** For primary bibliographic entry see Field 79.

**HYDROGRAPHY.** Illinois Univ. Engineering. For primary bibliographic entry see Field 79.

**VARIATION OF SMALL BR.** Simon Fraser Univ. Dept. of Geology. M. C. Roberts. Water Resources, 476, April 1978.

Descriptors: Drainage, Discharge(Water), Data, Hydrology, \*Hydrology, length, Discharge, Channel.

Short-term monitoring of Vancouver in its relationship stream network drainage diagram reveals (as measured rapidly on recessionary ground by individual relationship streamflow) W78-07505

**MANAGEMENT OF TROLLING AND ABSORBENT RETURN.** Cultural River Com. For primary bibliographic entry see Field 79.

**EVALUATION OF CALIFORNIA.** California Water Res. For primary bibliographic entry see Field 79.

**ON-FARM SEDIMENTATION.** Idaho Univ. Engineering. For primary bibliographic entry see Field 79.



## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Identification Of Pollutants—Group 5A

storm magnitude. Sediment mobilization begins when  $P = 140$  to  $150$  mm, or when short-term rainfall intensity =  $140$  to  $170$  mm/h. Qualitative and quantitative evidence suggests that a large, rare event is needed to modify the Big Thompson tributaries geomorphically. Catchment denudation values were used to estimate the recurrence interval of the 1976 event; the results suggested the possibility that previously estimated recurrence intervals may be too long by factors of 1.6 to 2.8. (Humphreys-ISWS)  
W78-07371

**SCOUR AND FILL IN STEEP, SAND-BED EPIHEMERAL STREAMS,**  
Missouri Univ., Columbia. Dept. of Geology.  
For primary bibliographic entry see Field 2J.  
W78-07379

**S-HYDROGRAPHS AND CHANGE OF UNIT HYDROGRAPH DURATION,**  
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2A.  
W78-07385

**VARIATION OF DRAINAGE DENSITY IN A SMALL BRITISH COLUMBIA WATERSHED,**  
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Geography.  
M. C. Roberts, and O. W. Archibold.  
Water Resources Bulletin, Vol. 14, No. 2, p. 470-476, April 1978. 4 fig, 9 ref.

Descriptors: \*Drainage, \*Channel flow, \*Canada, Drainage density, Watersheds(Basins), Discharge(Water), Streams, Expansion, Climatic data, Hydrographs, Hysteresis, Drainage effects, \*Hysteresis effect, \*British Columbia, Stream length, Discharge variations, Log-normal relationship, Channel network, Climatic variables.

Short-term fluctuations in stream length were monitored in a small watershed located 10 km east of Vancouver, British Columbia, Canada. Variation in discharge was reflected in a log-normal relationship with expansion and contraction of the stream net. The analysis of the variation of drainage density data using the individual hydrograph revealed a hysteresis effect. The stream net (as measured by drainage density) expanded more rapidly on the rising limb than it contracted on the recession limb. The experiment covered new ground by directly linking the drainage net to the individual hydrograph. Analysis showed the relationship between drainage net fluctuation and streamflow. (Roberts-ISWS)  
W78-07505

**MANAGEMENT GUIDELINES FOR CONTROLLING SEDIMENTS, NUTRIENTS, AND ADSORBED BIOCIDES IN IRRIGATION RETURN FLOWS,**  
Cultural Research Service, Kimberly ID. Snake River Conservation Research Center.  
For primary bibliographic entry see Field 5G.  
W78-07622

**EVALUATION OF SURFACE IRRIGATION RETURN FLOWS IN THE CENTRAL VALLEY OF CALIFORNIA,**  
California Univ., Davis. Dept. of Land, Air and Water Resources.  
For primary bibliographic entry see Field 5B.  
W78-07624

**ON-FARM METHOD FOR CONTROLLING SEDIMENT AND NUTRIENT LOSSES,**  
Idaho Univ., Moscow. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07626

**ECONOMIC ANALYSIS OF ON-FARM METHODS FOR CONTROLLING SEDIMENT AND NUTRIENT LOSSES,**  
Idaho Univ., Moscow.  
For primary bibliographic entry see Field 5G.  
W78-07627

## 5. WATER QUALITY MANAGEMENT AND PROTECTION

### 5A. Identification Of Pollutants

**RELATIONSHIP BETWEEN GROUNDWATER RESOURCES AND ENERGY PRODUCTION IN SOUTHWESTERN MISSOURI,**  
Missouri Univ., Columbia. Dept. of Geology.  
For primary bibliographic entry see Field 2K.  
W78-07202

**WATER-COLUMN AND BENTHIC INVERTEBRATE AND PLANT ASSOCIATIONS AS AFFECTED BY THE PHYSICO-CHEMICAL ASPECTS IN A MESOTROPHIC BAYOU ESTUARY PENSACOLA, FLORIDA,**  
University of West Florida, Pensacola. Water Resources Research Center.  
For primary bibliographic entry see Field 5C.  
W78-07203

**DETERMINATION OF TRACE ELEMENTS IN THE ENGLISH COULEE SYSTEM: PRESENCE DUE TO EXTENDED LIGNITE BURNING,**  
North Dakota Univ., Grand Forks. Dept. of Physics.  
G. I. Lykken.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 575, Price codes: A02 in paper copy, A01 in microfiche.  
North Dakota Water Resources Research Institute, Fargo, Completion Report W1-221-045-77, Nov. 1977. 14 p, 2 fig, 11 tab, 2 ref. OWRT A-055-NDAK(1), 14-34-0001-7072.

Descriptors: \*Lignite power plant, \*Trace elements, \*Neutron activation analysis, \*Pollutant identification, Soil analysis, Instrumentation, \*North Dakota(Grand Forks), English Coulee System(N Dak).

In an attempt to predict elemental concentration buildup in soils in the vicinities of large lignite burning plants coulee water, silt samples, and snow samples obtained near the University of North Dakota power plant located in Grand Forks, ND, were analyzed by neutron activation analysis for certain elements. No systematic buildup due to lignite burning was found. In an attempt to increase the sensitivity of a neutron activation analysis laboratory employing a 10 mg  $^{252}\text{Cf}$  source and a water moderator a cold neutron moderator employing mesitylene as the neutron moderating medium was designed and built. Favorable results were obtained with an indication that further design changes in the cold neutron moderator would yield greater sensitivities.  
W78-07208

**PRELIMINARY TESTS OF THE INFLUENCE OF WASTE WATERS FROM SUGAR FACTORIES ON THE NUMBERS OF INTESTINAL BACTERIA IN WATER (IN GERMAN),**  
Hygiene Stanice hl. m., Prague (Czechoslovakia).  
For primary bibliographic entry see Field 5C.  
W78-07223

**OIL POLLUTION MONITORING AND MONITORING UNIT,**  
Bailey Meters and Controls Ltd. (England). (Assignee).  
R. M. deVial, and P. M. Taylor.

U.S. Patent No. 4,057,721, 6 p, 2 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 2, p. 633, November 8, 1977.

Descriptors: \*Patents, \*Monitoring, \*Measurement, \*Sampling, \*Oil pollution, Fluorescence, Water pollution sources, Water quality control, Pollutant identification, Infra-red absorption procedures, Ballast water.

An oil-contaminated water stream is monitored by continuously exciting and measuring fluorescence in the stream at a monitoring point and producing a continuous monitoring indication, recurrently withdrawing from the stream samples of the contaminated water, determining the oil content of each sample by an infra-red absorption procedure, comparing each oil determination with the monitoring indication pertaining to the appropriate part of the stream and correcting or recalibrating the monitoring indication accordingly. This method exploits the fluorescent property of oil to allow continuous practically instantaneous monitoring. The monitoring indications are automatically recurrently re-calibrated or corrected by reference to determinations made within the range oil pollutions of the water which are actually experienced, with the avoidance or suppression of indications errors that might be present if the monitoring unit were calibrated only by the use of an artificial flow to which has been given an arbitrary degree of oil contamination. (Sinha-OEIS)  
W78-07234

**CONTAMINATING SPILL DETECTION ARRANGEMENT,**  
F. Meyers.  
U.S. Patent No. 4,058,802, 14 p, 9 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 3, p. 1005, November 15, 1977.

Descriptors: \*Patents, \*Monitoring, \*Oil pollution, \*Oil spills, Water quality control, \*Pollutant identification, \*Remote sensing, Sensors.

The object of this invention is to provide an improved hydrocarbon detection arrangement that is ruggedly built, has a comparatively long operation life and can indicate the presence of a hydrocarbon spill by transmitting a signal to places remote from the location of the spill in order that appropriate remedial steps to contain and/or remove the spill may be made. A number of detector stations are positioned in a body of water a predetermined locations. Each detector station is provided with at least one contaminant detector element and there may be up to six separate detector elements at each station. The detector station generally comprises a flotation arrangement for positioning the detector element at least partially submerged in the body of water. Each detector element at least partially responsive to the presence of the contaminant. The detector station comprises sensing means for sensing the change in the characteristic. A watertight compartment in each detector stations houses the necessary power supply, signal generating and transmitter. (Sinha - OEIS)  
W78-07241

**RATIOING METHODS APPLIED TO GAS CHROMATOGRAPHIC DATA FOR OIL IDENTIFICATION,**  
Coast Guard Research and Development Center, Croton, Connecticut.  
G. A. Flanagan.  
In: Proceedings of a Workshop on Pattern Recognition Applied to Oil Identification, held at Coronado, Calif. on November 11-12, 1976. IEEE Catalog No. 76CH1247-6C, 1977, p. 162-173, 6 fig, 2 tab, 3 ref.

Descriptors: \*Oil spills, \*Pollutant identification, Water pollution sources, \*Gas chromatography, Waste identification, Oil pollution, Log ratio.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

The use of six data normalization methods for gas chromatographic analysis of oils are described. The traditional problems encountered by the chromatographer are discussed and the influence of the ratioing methods on these problems are shown. One method, the log ratio method, was shown to be superior to the others. Highly comparable conditions for data analysis are achievable for the described chromatographic system. (See also W78-08934) (Sinha-OEIS) W78-07269

**TAXONOMIC STUDIES ON AQUATIC HYPHOMYCETES, I. LEMONNIERA DE WILDEMAN,** Exeter Univ., (England). Dept. of Biological Sciences.

E. C. Descals, J. Webster, and B. S. Dyko. Transactions of British Mycological Society, Vol. 69, No. 1, p. 89-109, 1977. 7 fig. 2 tab. 90 ref.

Descriptors: \*Classification, \*Fungi, \*Lemonniera, \*Hyphomycetes, Freshwater, Lemonniera aquatica, L. centrosphaera, L. cornuta, L. filiformis, L. terrestris, L. pseudofloccula.

A taxonomic revision of the genus *Lemonniera* de Wildeman, a freshwater aquatic fungus of the subclass Hyphomycetes, is presented, with culture, description, and general methods of isolation. The six accepted species of *Lemonniera* are illustrated, and an artificial key to the species included. The six species are *L. aquatica*, *L. centrosphaera*, *L. cornuta*, *L. filiformis*, *L. terrestris*, and *L. pseudofloccula*. The latter, a new species, is described. Neo-types are provided for *L. aquatica*, *L. cornuta*, and *L. filiformis*. The genus is based on *L. aquatica*, first found on submerged leaves in the Nancy (France) Botanical Gardens and described in 1894. De Wildeman drew attention to the abundance of freshwater hyphomycetes colonizing submerged plant material in 1893-95, but it was not until Ingold (1924) that the group was fully appreciated. Taxonomic revision was necessary because several genera contained heterogeneous elements. Collections for this study were made of submerged decaying plant material and foam scooped up with plastic vials and bags. The present study is intended as the first paper in a series of taxonomic revisions of Hyphomycetes. (Lynch-Wisconsin) W78-07271

**TOTAL ORGANIC HALOGEN AS WATER QUALITY PARAMETER: ADSORPTION/MICROCOLUMETRIC METHOD,** North Texas State Univ., Denton. Inst. of Applied Sciences; and North Texas State Univ., Denton. Dept. of Chemistry.

W. H. Glaze, G. R. Payton, and R. Rawley. Environmental Science and Technology, Vol. 11, No. 7, p. 685-690, July 1977. 3 fig. 4 tab. 15 ref. EPA R-803007-02 and R-803007-03.

Descriptors: \*Potable water, \*Indicators, \*Organic compounds, \*Water pollution control, \*Toxins, Adsorption, Halogens, Parameters, Carbon, \*Haloforms, \*Microcoulometers, Trihalomethane, Chlorine, Chlorides, Pollutants, Helium, Purging, Methodology.

There is growing concern that many if not most carbon-bound halogen compounds may be toxic. Levels of this substance in drinking water can be determined with a new method involving separation by adsorption onto macrorotational resin, followed by desorption, pyrolysis in oxygen, and microcoulometric detection. This method permits recovery and quantification of 60-100% of compounds tested (except long-chain chlorides) with a lower limit of about 2 micrograms/liter. Analysis of drinking water samples from four cities in different parts of the country, before and after purging with helium, shows great variation in non-halogen organic halogen content, not only in amount but in resistance to purging. The quantity TOX-HALOFORMS may be an important water

quality parameter, while comparison of that value with an analogous quantity for the purged water gives an indication of 'heaviness' of nonhaloform halogen compounds. The Dohrmann MCT-20 Microcoulometric Halide System, with an SBI single-boat inlet system, was used to determine halogen content of the ether elutions from XAD resins. Gas chromatography of the purgable volatiles was carried out on a Tracor 560 equipped with a 63Ni electron capture detector using a glass column (6 ft x 2 mm i.d.) containing 10% squalane on 100/120 Supelcoport. Nonpurgable volatiles were chromatographed on a Varian 1800 using a glass column containing 10% OV-11 on 100/120 Supelcoport. (Lynch-Wisconsin) W78-07273

**IMPROVED UNDER-WATER SAMPLER FOR LIMNOLOGICAL WORK,** Udaipur Univ. (India). Dept. of Zoology. For primary bibliographic entry see Field 7B. W78-07276

**A NEW DIALYSIS-ION EXCHANGE TECHNIQUE FOR DETERMINING THE FORMS OF TRACE METALS IN WATER,** Caulfield Inst. of Tech. Victoria (Australia). Water Studies Centre.

B. T. Hart, and S. H. R. Davies. Australian Journal of Marine and Freshwater Research, Vol. 28, No. 1, February 1977, p. 105-112. 2 fig. 4 tab. 7 ref.

Descriptors: \*Dialysis, \*Ion exchange, \*Trace elements, \*Metals, \*Measurement, \*Analytical techniques, Methodology, \*Pollutant identification, Water pollution, Cadmium, Copper, Lead, Zinc, Iron, Rivers, Solubility, Membranes, Filtration, Australia.

A combined dialysis-ion exchange separation method for determining soluble trace metals in natural waters shortens the time for complete dialysis of all dialysable species to an optimum five hours; the technique was tested for cadmium, copper, lead, zinc, and iron in synthetic solutions prepared from distilled, deionized water. Almost 100% of added trace metals were dialyzed during the five hours. The major advantage of dialysis is considerable reduced membrane pore size-suggested at about 1 nm. Difficulties include: (1) likelihood the membrane will be negatively charged in aqueous solution, retarding passage of negatively charged trace metals; and (2) conventional dialysis requires over 24 hours for equilibration. The dialysis unit was taken from a Technicon Auto Analyzer II, and Cuprophane membranes were used, consisting of regenerated cellulose with a pore size of 0.8 nm. Two peristaltic pumps forced liquid through the unit at 5 ml/min. An ion exchange column containing 3 g Chelex-100 resin removed ions from solution. Optimum dialysis time for the trace metals was determined in three series of tests: (1) with synthetic solutions and metal concentrations 1-2 times higher than natural; (2) with synthetic samples and near-natural levels; and (3) with 'synthetic natural' water and ionic levels typical of upper reaches of the Murray River, Australia. Three natural river water samples were also dialyzed. (Lynch-Wisconsin) W78-07277

**A STUDY OF DIFFERENT ANALYTICAL EXTRACTION METHODS FOR NONDETRITAL HEAVY METALS IN AQUATIC SEDIMENTS,** Canada Centre for Inland Waters, Burlington (Ontario).

H. Agemian, and A. S. Y. Chau. Archives of Environmental Contamination and Toxicology, Vol. 6, No. 1, p. 69-82, 1977. 3 fig. 2 tab. 16 ref.

Descriptors: \*Heavy metals, \*Sediments, \*Methodology, \*Separation techniques, \*Analytical techniques, \*Pollutant identification,

Rideau River (Ont). Canada. Pollutants, Water pollution, Acids, Hydrochloric acid, Acetic acid, Nitric acid.

Twenty-four sediment samples from the Rideau River, Ontario, Canada, were used to test comparable usefulness or five extraction methods for heavy metals; two partial extraction methods were found to be suitable. A total extraction method using a Parr 4745 acid digestion bomb was compared to four partial extraction methods: (1) 4.0 N nitric-0.7 N hydrochloric acid solution for 2 hrs at 70-90°C; (2) 0.5 N hydrochloric acid solution overnight at room temperature; (3) 1 N hydroxylamine hydrochloride + 25% acetic acid solution for 2 hrs at 70-90°C; and (4) 0.05 N EDTA solution of pH 4 for 2 hrs at 70-90°C. Resulting solutions were analyzed for cadmium, copper, lead, zinc, nickel, chromium, cobalt, manganese, iron, and aluminum. Results showed that: (1) methods 2 and 4 are suitable for simultaneous extraction of all metals analyzed from the organic adsorbed and precipitated phases of sediments, with method 2 preferred for authentically formed metals; (2) method 1 attacks the aluminosilicate crystal lattice, and thus may provide misleading environmental information if the mineralogy of the area is not constant; and (3) method 3 is unsuitable for copper extraction, although it is satisfactory for extraction of ferromanganese and carbonaceous minerals and adsorbed trace elements. The latter method has no effect on authentically-formed sulfide minerals and organic complexes, and therefore is unusable for simultaneous of a large number of the nonsilicate authentically formed elements. (Lynch-Wisconsin) W78-07278

**LAND USE AND POLLUTION PATTERNS OF THE GREAT LAKES,** Cold Regions Research and Engineering Lab. Hanover, NH. For primary bibliographic entry see Field 5B. W78-07288

**AN IN SITU STUDY OF RECRUITMENT GROWTH AND SURVIVAL OF SUBTIDAL MARINE ALGAE: TECHNIQUES AND PRELIMINARY RESULTS,** California Univ., Santa Barbara. Dept. of Biological Sciences; and California Univ., Santa Barbara. Marine Science Inst. For primary bibliographic entry see Field 5C. W78-07308

**WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1976,** Geological Survey, St. Paul, MN. Water Resources Div. For primary bibliographic entry see Field 7C. W78-07313

**WATER RESOURCES DATA FOR ARKANSAS, WATER YEAR 1976,** Geological Survey, Little Rock, AZ. Water Resources Div. For primary bibliographic entry see Field 7C. W78-07314

**THE ROLE OF SURFACE MICROLAYER OF WATER IN THE DISTRIBUTION AND FATE OF TRACE ORGANIC CONTAMINANTS: A FEASIBILITY STUDY,** Missouri Univ.-Rolla. Dept. of Chemistry. For primary bibliographic entry see Field 5B. W78-07319

**RADIONUCLIDE CONCENTRATIONS IN THE ARKANSAS RIVER UPSTREAM AND DOWNSTREAM FROM THE NUCLEAR POWER GENERATING FACILITY,** Arkansas State Univ., University. Dept. of Physical Sciences.

For primary bibliographic entry see Field 5B. W78-07320

**MONITORING OF LOVIBRIO BACTERIA IN GRASSHOPPER PRESENT IN ST. AUBURN UNIV.,** J. M. Westergaard. Available from Information Service, Springfield, Price codes: A0. Water Resources University, Burlington, fig. 41 tab. 44 ref.

Descriptors: \*Bacteria, \*Aquatic treatment, \*Water identification, \*Lobivibrio, \*Bacteria.

Water sample streams, waste municipal waste, burn area, and parameter lovibrio. Eight examined for bacteria community gram negative bacteriocytes: Fibronectase, bacterium violace interaction showed that E. coli and S. aureus possess a carbon complement test with the E. coli and S. aureus wastewater filters of Escherichia coli into a small-scale system were lovibrio and t. period. It was conditions between Bdeh treatment system minor role in W78-07323

**MISSOURI PROJECT RIVER FIVE MARK POLLUTION WATER PLANTS OF MISSOURI,** National Environmental, OH. Ac. Lab. H. H. Tabak. Available from Information Service, Price codes: A0. May 25, 1970.

Descriptors: \*Missouri, \*Seaweed, \*City (IA), \*City (MO), \*Cholestanols, runoff, Effluent technique.

Coprostanol, warm-blooded, the sole source, mate the extension in a study.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Identification Of Pollutants—Group 5A

For primary bibliographic entry see Field 5B.  
W78-07320

### MONITORING OF WATERS FOR BDELLOVIBRIO BACTERIOVORUS - A PARASITE OF GRAM NEGATIVE ENTERIC BACTERIA PRESENT IN SEWAGE.

Auburn Univ., A.L. Dept. of Microbiology.  
J. M. Westergaard, T. T. Kramer, and A. I. Swann.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 792.  
Price codes: A05 in paper copy, A01 in microfiche.  
Water Resources Research Institute, Auburn University, Bulletin 29, September 1977. 77 p. 9 fig. 41 tab, 44 ref, append. OWRT B-061-ALA(1).

Descriptors: \*Pathogenic bacteria, \*Sewage bacteria, \*Aquatic bacteria, Microorganisms, Sewage treatment, Waste water treatment, \*Pollutant identification, \*Monitoring, Alabama, \*Bdellovibrio, Coliforms, Enteric bacteria.

Water samples collected from wells, ponds, streams, wastewater oxidation lagoon systems and municipal wastewater treatment plants in the Auburn area were examined for both *Bdellovibrio* and parameters important for the growth of *Bdellovibrio*. Eight locally isolated *Bdellovibrio* strains examined for lytic activities against a variety of bacteria commonly found in fecal polluted waters lysed gram negative bacteria of the families Enterobacteriaceae, Pseudomonadaceae, Bifidobacteriaceae, Neisseriaceae, but not Chromobacterium violaceum. The study on *Bdellovibrio*-host interaction under different growth conditions showed that *Bdellovibrio* strain MS7 could form plaques on *Escherichia coli* lawns within the temperature range of 15 to 43 degrees C, but not at 10 degrees C or at 45 degrees C. Twelve *Bdellovibrio* isolates established as stock strains were found to possess a common antigen as expressed by the Complement Fixation Test and Immunodiffusion test with the *Bdellovibrio* reference strains UK12, 6-5-5 and 109D. Wastewater and .22 µm pore size wastewater filtrates inoculated with equal numbers of *Escherichia coli* and of *Bdellovibrio* cells into a small-scale laboratory wastewater treatment system were tested at regular intervals for *Bdellovibrio* and total coliform counts during a 9-day period. It was concluded that rather steady-state conditions exist concerning the interaction between *Bdellovibrio* and coliforms in municipal treatment systems and that *Bdellovibrio* only has a minor role in biologic wastewater purification.  
W78-07323

### MISSOURI RIVER BASIN STEROL ASSAY PROJECT REPORT. COPROSTANOL, A POSITIVE MARKER OF DOMESTIC AND RUN-OFF WASTE-WATER PLANT EFFLUENTS AND SURFACE WATERS OF THE LOWER MAIN STEM MISSOURI.

National Environmental Research Center, Cincinnati, OH. Advanced Waste Treatment Research Lab.  
H. H. Tabak, and R. L. Bunch.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 930.  
Price codes: A02 in paper copy, A01 in microfiche.  
May 25, 1976. 16 p. 1 fig, 2 tab, 2 ref, 2 append.

Descriptors: \*Coprostanols, \*Bioindicators, \*Missouri River, \*Water pollution sources, \*Sewage disposal, Sewage treatment, Sioux City (IA), Omaha (NE), St. Joseph (MO), Kansas City (MO) KS, Gas chromatography, Cholestanols, Sterols, Assay, Rivers, Agricultural runoff, Effluents, Waste water disposal, Analytical techniques, Domestic wastes, Coliforms.

Coprostanol, a principal sterol in human and warm-blooded animal feces (in turn thought to be the sole source of this compound) was used to estimate the extent and main sources of fecal pollution in a study of water samples of the lower Mis-

souri River. Coprostanol can be removed from wastewater by adequate secondary treatment. Sampling at 28 stations in the Sioux City, Iowa; Omaha, Nebraska; St. Joseph, Missouri; and Kansas City, Missouri/Kansas areas January-March 1970 showed that sewage treatment plant effluent had significantly higher coprostanol concentrations than river samples taken just above outfalls or further downstream. Treatment plant effluents contained these coprostanol concentrations (in micrograms/l): Sioux City, 636-794; Omaha (2 stations), 743-864 and 250-362; St. Joseph (4 stations), 391-484, 465-573, 365-498, and 424-535; and Kansas City (3 stations), 496-587, 259-319, and 328-419. Microbiological data substantiated these findings; treated sewage contained fecal coliforms in the millions/100 ml range, while surface river samples above and below outfalls were lower. A hog, cow, or human excretes about 800-1000 mg coprostanol/day, resulting in a concentration of 210-250 micrograms/l in raw wastewater. This range was considerably exceeded in the samples. Analytical techniques of Murtaugh and Bunch were modified for this analysis; a new packing was used for the gas-liquid chromatography column to permit free sterols to be run. (See also W78-07329) (Lynch-Wisconsin)  
W78-07328

### MISSISSIPPI RIVER BASIN STEROL ASSAY PROJECT REPORT. COPROSTANOL, A POSITIVE MOLECULAR MARKER OF DOMESTIC AND RUN-OFF SEWAGE, WASTEWATER PLANT EFFLUENT AND SURFACE WATERS IN THE BURLINGTON, IOWA AREA ON THE MISSISSIPPI RIVER.

National Environmental Research Center, Cincinnati, OH. Advanced Waste Treatment Research Lab.  
H. H. Tabak, and R. L. Bunch.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 929.  
Price codes: A02 in paper copy, A01 in microfiche.  
November 30, 1970. 14 p. 1 fig, 2 tab, 3 ref, 2 append.

Descriptors: \*Coprostanol, \*Mississippi River, \*Burlington (IA), \*Bioindicators, \*Water pollution sources, \*Sewage disposal, Sewage treatment, Waste water disposal, Iowa, Sterols, Domestic wastes, Agricultural runoff, Coliforms, Assay, Gas chromatography, Rivers, Effluents, Influent streams, Analytical techniques.

The extent and main sources of fecal pollution in the Mississippi River at Burlington, Iowa were determined through analysis of water samples for coprostanol, a major sterol in human and warm-blooded animal feces. Such feces are thought to be the only source of coprostanol, which, as with other sterols, can be removed from wastewater by adequate secondary sewage treatment. Samples from seven stations within three miles of Burlington showed significantly higher coprostanol concentrations in sewage treatment plant influent and effluent than in river surface samples taken above or below the effluent discharge area. Data showed no significant reduction in coprostanol concentration in treated effluent versus raw sewage influent, demonstrating inadequacy of primary sewage treatment in removing sterols. Surface water samples upstream from the treatment plant averaged 8, 7, and 6 micrograms coprostanol/l. Treatment plant influent contained 245-394 micrograms/l (average 316), while treated effluent samples contained 160-315 micrograms/l (average 240). Samples taken at the treatment plant mixing zone about 265 ft downstream showed concentrations of 28-35 micrograms/l (mean 31). Analytical techniques of Murtaugh and Bunch were modified for this analysis; a new packing was used for the gas-liquid chromatography column to permit free sterols to be run. (See also W78-07328) (Lynch-Wisconsin)  
W78-07329

### ANALYSIS OF VARIOUS IOWA WATERS FOR SELECTED PESTICIDES: ATRAZINE, DDE, AND DIELDRIN--1974.

Atomic Energy Commission, Ames, IA.  
J. J. Richard, G. A. Junk, M. J. Avery, N. L. Nehring, and J. S. Fritz.  
Pesticides Monitoring Journal, Vol. 9, No. 3, December 1975, p 117-123. 3 fig, 8 tab, 16 ref. NSF GP 33526X.

Descriptors: \*Pesticide residues, \*Atrazine, \*Dieldrin, \*DDE, \*Iowa, Herbicides, Insecticides, Pesticides, Gas chromatography, Watersheds(Basins), Surface waters, Subsurface waters, Waste treatment, Potable water, Water pollution sources, DDT, Agricultural runoff, Crop production, Corn(Field).

A study of dissolved residues of the pesticides atrazine, DDE, and dieldrin in surface, subsurface, and finished drinking waters in Iowa shows contamination in every major watershed in the state. Current treatment processes, including activated carbon filtration, do not effectively remove these pesticides. Concentrations vary from 0.5-42,000 parts per trillion by weight, and seasonal variation are consistent with agricultural runoff models. Atrazine concentrations are highest of the three, reflecting its widespread use for weed control in cornfields; significant amounts of DDE give further evidence of the persistence of DDT and its metabolites. Dieldrin levels are generally much lower. Water from several shallow wells and finished water from treatment plants are also contaminated. The survey, conducted during the 1974 growing season, included all major watersheds and several smaller ones. The survey of finished water covers most major cities. No attempt was made to measure pesticides sorbed in suspended particles during periods of heavy runoff, so pesticide content of surface waters reported here understates actual levels. Values given for subsurface and finished waters are accurate. Pesticide residues were separated from interferences using gas chromatography. Tables present pesticide concentrations in various streams, lakes, reservoirs, ponds, ditches, and finished waters. (Lynch-Wisconsin)  
W78-07331

### DETECTION OF NONPOINT POLLUTION OF SMALL STREAMS IN SOUTHWESTERN CONNECTICUT.

Fairfield Univ., CT. Dept. of Biology.  
S. Bongiorno, R. Gumbardo, G. Macina, S. Foley, and T. Saboe.  
American Laboratory, Vol. 8, No. 12, December 1976, p 9-19. 4 fig, 2 tab, 30 ref.

Descriptors: \*Nonpoint pollution, \*Fairfield(CT), \*Water pollution sources, \*Streams, \*Water pollution control, \*Urban runoff, Sewage treatment, Sewage disposal, Rooster River(CT), Mill River(CT), Sasco Brook(CT), Connecticut, Watersheds(Basins), \*Urbanization, Tributaries, Storm runoff, Nutrients.

Monitoring the Rooster and Mill Rivers and Sasco Brook at Fairfield, Connecticut indicates that sanitary sewerage does not maintain water quality against downgrading by street and surface runoff. Urbanization is likely to reduce stream water quality with or without sewage treatment. Recommended control measures include: (1) conservation of wetland muds; (2) preservation of 300-ft strips of natural vegetation along streambanks to trap nutrients on land; (3) use of ornamental rough-ground cover to entrap natural mulches; and (4) encouraging urban runoff retention through underdesigned storm sewers, porous pavements, and storm retention ponds. The 36 sq km Rooster River watershed is 40-50% in town; the 77 sq km Mill River watershed is 30-35% in town, and the 19 sq km Sasco Brook basin lies 85-90% in town. There is no industrial point source inputs to any of the three streams. Of the watersheds, the Rooster is highly urbanized, the Mill is moderately ur-



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

banized, and the Sasco is semirural. Over 90% of homes in the Rooster River basin are connected to sewer systems, while in the other two basins all disposal is to septic tanks. Water samples, collected in 1971-73 and 1975-76, were tested for DO, pH, alkalinity, conductance, ammonia, nitrite, nitrate, sulfate, and hardness. Where urbanization was high (as in the Rooster River), all pollution indicators were high, while the areas of low urbanization all pollution parameters were low, with the exception of higher ammonia concentrations in Sasco Brook. (Lynch-Wisconsin)  
W78-07334

**WATER RESOURCES OF THE WEISER RIVER BASIN, WEST-CENTRAL IDAHO,**  
Geological Survey, Boise, ID. Water Resources Div.  
For primary bibliographic entry see Field 4A.  
W78-07342

**AVAILABILITY AND QUALITY OF GROUND WATER IN THE DRAIN-YONCALLA AREA, DOUGLAS COUNTY, OREGON,**  
Geological Survey, Portland, OR. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W78-07347

**SALINITY: ITS DEFINITION AND CALCULATION,**  
Department of the Environment, Victoria British (Columbia). Frozen Sea Research Group.  
For primary bibliographic entry see Field 2K.  
W78-07367

**DYE INFUSION TECHNIQUE ASSESSES STREAM POLLUTION IN OHIO,**  
Youngstown State Univ., OH. Dept. of Chemical Engineering.  
For primary bibliographic entry see Field 5B.  
W78-07373

**DETERMINATION OF TOTAL ORGANIC CARBON IN POTABLE WATER, SEWAGE, INDUSTRIAL EFFLUENTS, AND BOILER FEED WATER,**  
Badische Anilin-und Soda-Fabrik A.G., Ludwigshafen am Rhein (West Germany).  
W. Merz.  
American Laboratory, Vol. 8, No. 12, December 1976, p 29-38, 3 fig, 4 tab, 6 ref.

Descriptors: \*Pollution identification, \*Total organic carbon, \*Carbon, \*Methodology, Equipment, \*Measurement, \*Indicators, \*Analytical techniques, Instrumentation, Volumetric analysis, Potable water, Effluents, Industrial wastes, Boiler feed water, Organic compounds, Carbon dioxide, Chemical oxygen demand.

A new universal method for determining total organic carbon (TOC), total carbon (TC), and total inorganic carbon (TIC) is applicable to potable water, sewage, industrial effluents, and boiler feed water. In this method, the organic sample is burned very rapidly in a stream of oxygen, and the resulting carbon dioxide is titrated continuously and automatically with tetrabutylammonium hydroxide. For TIC determination the sample is acidified and evolved carbon dioxide is swept into an absorption cell for continuous titration. The difference between TC and TIC yields the value for TOC. This approach is superior to direct TOC determination since no volatile carbon compounds are lost. Eight minutes is needed per determination. TOC can be determined in waters containing waste acids of intermediate concentration; acid anions are bound in the water separator by means of the corresponding cations. Sulfur dioxide must be oxidized by addition of hydrogen peroxide to the separator. For samples containing HCl the silver filling is omitted from the combustion tube

and chloride is retained in the water separator as silver chloride. The great advantage over methods using infrared or thermal conductivity finish is that samples up to 5 ml may be taken, thus minimizing the effect of suspended matter. Unfiltered samples may be used if turbidity is not excessive. (Lynch-Wisconsin)  
W78-07404

**CHLORINE DETECTOR SAVES A LIFE.**  
Public Works, Vol. 109, No. 3, p 77-78, March, 1978.

Descriptors: \*Chlorination, \*Disinfection, Equipment, \*Instrumentation, \*Monitoring, \*Chlorine, Warning systems, Hazards, Waste water treatment, Treatment facilities, Municipal wastes, \*Pollutant identification, Air pollution.

A Chloralert chlorine detector, installed in a municipal treatment facility in Dover, New Hampshire, was responsible for detecting a potentially fatal chlorine leak. The Chloralert system, developed by the Fischer and Porter Co, continuously samples the air through an intake pipe connected to a suction system. Because chlorine is twice as heavy as air, the chlorine monitor is located at floor level. The Chloralert is capable of detecting chlorine levels to 1 ppm. The monitor system is equipped with an automatically activated flasher and an external bell. Chlorine at the Dover waste water treatment plant is surveyed continuously; the Chloralert monitor is connected by an output terminal to a remote alarm at the police station. Chlorine detectors are required in all new treatment facilities in New Hampshire. (Lisk-FIRL)  
W78-07453

**GAS MONITORS FOR SEWAGE TREATMENT WORKS.**  
Canadian Chemical Processing, Vol. 61, No. 12, p 682, 685, December, 1977.

Descriptors: \*Gases, \*Instrumentation, \*Monitoring, \*Measurement, \*Remote sensing, Sewage sludge, \*Pollutant identification, Analytical techniques, Methane, Digital computers, Calibrations, Catalysts, Waste water treatment, Treatment facilities, Municipal wastes.

A gas monitoring device for sewage treatment facilities, developed by Neotronics Ltd, prevents poisoning of the catalytic sensing element by reducing the exposure to heat and using digital calibrations. Catalytic sensing devices for monitoring sludge gases and silicone vapors often fail within a short period of time as a result of heating of the catalyst which oxidizes the gaseous materials. The Neotronics gas monitoring device is equipped with a Pellistor catalytic sensing head which is heated for 10 seconds every 4 min. Gas monitoring data is collected by a digital sensing circuit which compares the information to a digital logic format. In the presence of catalytic poisoning, the sensing circuit registers a zero condition to which the digital logic responds with an alarm. When catalytic poisoning is not present, the calibration stability increases 20 fold with zero or stability drift. The system is equipped with a fail-safe instrument malfunction indicator. (Lisk-FIRL)  
W78-07454

**PH AVERAGING,**  
State Univ. of New York at Buffalo. Dept. of Civil Engineering.  
A. E. Erlep, and M. B. Tomson.  
Journal Water Pollution Control Federation, Vol. 50, No. 2, p 389-392, February, 1978, 1 fig, 2 tab, 7 ref.

Descriptors: \*Hydrogen ion concentration, \*Acid-base equilibrium, \*Water chemistry, \*Nitrogen compounds, \*Nitrification, Analytical techniques,

Mathematical models, Phosphorus, Chemical properties, Waste water treatment.

Numerical pH averaging procedures were evaluated with mathematical models considering pH as an intensity factor and as a capacity factor. pH is illustrated as an intensity factor in protonated and unprotonated systems. A system can display various pH values during proton additions and removals, making it possible for pH values to be registered as acidic for part of the recorded time and basic for the remainder. Simple numerical averaging of pH measurements may yield erroneous data if the average numerical value is assumed to be representative of the series of continuous measurements. This becomes especially significant when the average pH value is used to monitor a waste treatment process, such as nitrogen stripping, which is only operable within a specific pH range. Numerical averaging when pH is an intensity factor is valid only when standard deviations and other parameters are considered. Numerical averaging of pH as a capacity factor is suitable for elements which exhibit conservative behavior, such as divalent calcium and sodium. (Lisk-FIRL)  
W78-07456

**THE BACKGROUND TO, AND THE APPLICATION OF, LABORATORY INSTRUMENTATION TO WATER ANALYSIS,**  
Pye Unicam Ltd., Cambridge (England) ACU Applications Labs.  
C. T. Cottrell.  
Water Services, Vol. 81, No. 981, p 663-666, November, 1977, 5 fig, 1 tab, 21 ref.

Descriptors: \*Pollutant identification, \*Instrumentation, \*Gas chromatography, Water analysis, \*Ultraviolet radiation, \*Infrared radiation, Spectrophotometry, Spectroscopy, Analytical techniques, Chemical analysis, Metals, Organic wastes, Pesticide residues, Industrial wastes, Municipal wastes.

Analytical techniques to measure pollutants in water are described, including: gas-liquid chromatography, atomic absorption spectrophotometry, ultraviolet and visible spectrophotometry, automatic chemistry system, infrared spectroscopy. Chlorinated and organophosphorus pesticides, petroleum hydrocarbons, phenols, organo mercury compounds, fatty acids are identified with gas-liquid chromatography in conjunction with thermal conductivity, flame ionization, electron capture, fluorimetric, and alkali flame ionization detection. Atomic absorption spectrophotometers of the single- or double-beam variety are employed to detect 66 metallic elements contained in waste water. Single- and double-beam ultraviolet and visible spectrophotometers measure non-metallic inorganic nutrients, detergents, organic compounds, color and turbidity. Spectrophotometrically visible substances, such as ammonia, chloride, silicate, nitrate, nitrite, and phosphate, are analyzed by automatic chemistry systems. Double-beam infrared spectroscopy is used to identify organic compounds, in industrial wastes, Detergents, chlorinated pesticides, carbohydrates, and amino acids. (Lisk-FIRL)  
W78-07458

**MEDICALLY USED RADIONUCLIDES IN SEWAGE SLUDGE,**  
Lund Univ. (Sweden); and Lund Inst. of Tech. (Sweden). Dept. of Nuclear Physics.  
B. Erlandsson, and S. Mattsson.  
Water, Air, and Soil Pollution, Vol. 9, No. 2, 199-206, 1978, 3 fig, 2 tab, 6 ref.

Descriptors: \*Radioisotopes, \*Radioactive waste disposal, \*Sewage sludge, \*Iodine radioisotopes, \*Hospitals, Gold radioisotopes, Thallium radioisotopes, Spectrometers, Biological treatment, Sludge digestion, Waste water treatment, Municipal wastes.

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W78-07460

**MEASUREMENTS IN DIGESTION OF CANADA CATTLE (ONTARIO).**  
D. L. Liu.  
Water and...  
44, March

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# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Identification Of Pollutants—Group 5A

Sewage sludge from the municipal waste water treatment plant in Malmö, Sweden, was analyzed for concentrations of radionuclides using a Ge(Li)-spectrometer. The radionuclides had been discharged by one of the town's hospitals which used the radioisotopes for medical procedures. The plant treated wastes from a population of 225,000 using partial biological treatment and sludge digestion, producing 1,320 cu m of digested sludge monthly with a solid content of 23%. The concentration of iodine-131, which is orally administered to and subsequently excreted by patients at the hospital, ranged from 0.03-0.12 nanocuries/kg, assuming a sewage-to-sludge iodine-131 concentration ratio of 6:1. Concentrations of gold-198 were 0.030-0.069 nanocuries/kg in two samples but were below detection limits in the remainder. Gamma ray emissions by other radionuclides interfered with analyses for strontium-85 which was discharged to the treatment plant at a rate of about 0.2 microcuries/week. (Lisk-FIRL) W78-07460

**MEASURING PETROLEUM HYDROCARBONS IN DIGESTED SEWAGE SLUDGES,**  
Canada Centre for Inland Waters, Burlington (Ontario).  
D. L. Liu.  
Water and Sewage Works, Vol. 125, No. 3, p 40-44, March, 1978. 11 fig, 2 tab, 13 ref.

Descriptors: \*Lipids, \*Oil wastes, \*Organic compounds, \*Analytical techniques, \*Infrared radiation, Gas chromatography, Mass spectrometry, Microbiology, Water analysis, Waste water treatment, Municipal wastes.

Lipids and petroleum hydrocarbons contained in anaerobically digested sewage were measured in samples from three Canadian municipal sewage treatment plants by infrared, gas chromatography, mass spectrum, and microbiological assay techniques. Land application of digested alum sewage sludge from the Point Edwards treatment plant in Ontario inhibited the growth of orchardgrass. A comparison of the composition of this sludge with iron sludge from North Toronto and lime sludge from Newmarket yielded no significant differences. The Point Edwards sludge contained a lipids concentration of 23% by sludge dry weight. Total lipid concentrations in the anaerobically digested chemical sewage sludges were: 10,403 mg/liter in the alum sludge, 636 mg/liter in the iron sludge, and 733 mg/liter in the lime sludge. Petroleum hydrocarbon concentrations in the sludge were 7,580 mg/liter for the alum sludge, 524 mg/liter in the iron sludge, and 434 mg/liter in the lime sludge. Gas chromatography revealed that a higher percentage of the petroleum hydrocarbons in the sludges were fractions of the high molecular weight n-paraffin, indicating that motor oil and grease were components of the petroleum hydrocarbons. Three saturated fatty acids, myristic, palmitic, and stearic acids, were found in the alum sludge as products of hydrocarbon oxidation. (Lisk-FIRL) W78-07462

**NEW PROCEDURE DETERMINES AEROBIC SLUDGE STABILITY,**  
Virginia Univ., Charlottesville. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5D. W78-07464

**MONITORING IN THE ZONE OF AERATION,**  
SCS Engineers, Long Beach, CA.  
R. Morrison, and M. Bulot.  
Public Works, Vol. 109, No. 4, p 64-65, April, 1978. 2 fig, 8 ref.

Descriptors: \*Lysimeters, \*Moisture meters, \*Infiltrometers, \*Pollutant identification, \*Vadose water, Soil moisture meters, Saturated soils,

Water table, Groundwater, Instrumentation, Construction materials, Zone of aeration, Monitoring, Analytical techniques, Soil water movement, Waste water disposal, Municipal wastes.

SCS Engineers of Long Beach, California, has developed pressure/vacuum lysimeters and moisture cells for detecting the infiltration of pollutants through the soil to the groundwater. The monitors are installed above the water table, in the aeration of vadose zone, to trace the path of leachates carried via interstitial water from waste disposal sites. The 3 ft-long polyvinyl chloride lysimeter has a porous ceramic cup at one to filter the elements of the leachate. Two polyethylene tubes mounted in a rubber stopper at the other end of the lysimeter are used to collect the water sample and pressurize and evacuate the tube. Although they cannot provide water samples for subsequent analysis, moisture cells can yield information on the amount of soil water present with respect to established background levels. In the moisture cell, two plates are separated by a processed fiberglass binding which expands or contracts with respect to variations in the soil interstitial moisture content. Moisture cells can be used to detect infiltration to the aeration zone beneath lined waste disposal lagoons located in areas for which the field capacity is known. (Lisk-FIRL) W78-07470

**RECYCLING OF WATER FOR IRRIGATION; PERSISTENCE OF ENTEROVIRUSES IN SEWAGE EFFLUENT AND NATURAL WATERS RECEIVING THE EFFLUENT,**  
Hawaii Univ., Honolulu. Water Resources Research Center.  
For primary bibliographic entry see Field 5B. W78-07471

**SAMPLING OF WATER AND WASTEWATER,**  
EG and G Washington Analytical Services Center, Inc., Rockville, MD.  
P. E. Shelley.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 664, Price codes: A14 in paper copy, A01 in microfiche. Report EPA-600/4-77-039, August 1977. 320 p, 7 fig, 11 tab, 21 ref, 1 append.

Descriptors: \*Pollutant identification, \*Monitoring, \*Sampling, \*Instrumentation, \*Measurement, \*Analytical techniques, Equipment, Design data, Data collections, Automation, On-site data collections, Manual control, Waste water (Pollution).

Water quality monitoring techniques, practices, and equipment designs are reviewed for waste water and water sampling procedures. Sample types are classified and recommendations for handling, preservation, and quality are made. Information on site selection, sampling frequency, and source flows is presented. Situations in which manual or automatic samplers are preferred are identified; sampler intake, gathering, transport, and storage designs are evaluated. Automatic sampling equipment is reviewed, including commercially-marketed and custom-designed equipment. Field sampling procedures are recommended with respect to automatic and manual sampling techniques and equipment maintenance. A thorough evaluation of 266 automatic sampling devices and custom designed units is included. (Lisk-FIRL) W78-07517

**WATER/WASTEWATER SURVEY GUIDELINES,**  
Construction Engineering Research Lab. (Army), Champaign, IL.  
G. W. Schanche, L. A. Greep, J. R. Cannon, and B. A. Donahue.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033

223, Price codes: A04 in paper copy, A01 in microfiche. Report No. CERL-TR-N-11, November 1976. 55 p, 11 fig, 12 tab, 1 append.

Descriptors: \*Surveys, \*Data collections, \*Statistical methods, \*Measurement, \*Flow profiles, Flow measurement, Sites, Water law, Water quality, Sampling, Design data, Waste water treatment, Municipal wastes.

A survey format provides guidelines for improving data collection and analysis techniques in the design, planning, and installation of water and waste water treatment facilities. The guidelines are constructed to assist in the preparation and performance of water and waste water surveys by supplying a format for collecting specific background data. Conceptual guidelines are offered for conducting waste water mass balances, designing sampling schedules, and measuring waste water flows. Survey designs for water law compliance, waste source identification, and ambient water quality evaluation are presented. Information from these surveys is employed in evaluating environmental impact, characterizing design problems, and analyzing designs. Background information on sampling sites, waste water sources, and flow measurement techniques is provided. (Lisk-FIRL) W78-07522

**VIRION AGGREGATION AND DISINFECTION OF WATER VIRUSES BY BROMINE,**  
North Carolina Univ. at Chapel Hill. Dept. of Bacteriology.  
For primary bibliographic entry see Field 5F. W78-07524

**INSTRUMENTATION AND AUTOMATION IN WATER AND WASTEWATER TREATMENT,**  
Philips Environmental Protection, Eindhoven (Netherlands).  
H. C. Brinkoff.  
Water Pollution Control, Vol. 77, No. 1, p 55, 1978.

Descriptors: \*Automation, \*Instrumentation, Equipment, \*Treatment facilities, \*Measurement, Analytical techniques, Computers, Control systems, Colorimetry, Conductivity, Turbidity, Electrodes, Optimization, Waste water treatment, Municipal wastes.

The instrumentation of an automated waste water treatment facility in the Netherlands is described. The plant utilizes process stream analyzers, sensors, telemetry, and computers. The combustion of organic matter at 900C with a catalyst is monitored for total oxygen demand by a meter located near the conditioned gas stream containing the organic wastes. Coulometric titration restores the oxygen from combustion to its original condition. Electro-chemical water quality sensors measure pH, conductivity, dissolved oxygen, and redox potential. An ion-sensitive electrode is used to monitor chlorides; additional instruments record temperature and turbidity measurements. An automatic electrode calibration unit compares on-site measurements with levels experienced under laboratory conditions. An ultrasonic transducer automatically unclogs the sensors; the optimum design of the sampling unit and measuring cell also contributes to accuracy. Automation of Amsterdam's potable water treatment plant is in progress. Optimization of the sewage treatment plant during large flows will be achieved when the automation of the main pipelines is completed. (Lisk-FIRL) W78-07525

**USE OF BENTHIC SEDIMENTS AS INDICATORS OF MARINA FLUSHING,**  
Oregon State Univ., Corvallis. Dept. of Ocean Engineering.  
L. S. Slotta, and S. M. Noble.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

Sea Grant College Program, Publication No. ORESU-T-77-007, October 1977. 56 p, 29 fig, 20 tab, 23 ref, 2 append. SG-04-6-158-44004, NSF-GI-34346.

Descriptors: \*Estuaries, \*Sediments, \*Marinas, \*Water quality, \*Estuarine environment, \*Bottom sediments, \*Indicators, \*Pollution indexes, \*Benthic sediments, \*Flushing, \*Boat basins, \*Estuarine circulation.

The findings of a sediment analysis program formulated to determine the flushing potential of various shaped small boat basins are presented. Chemical tests regarding volatile solids, Kjeldahl nitrogen, grease and oil, and sulfides were performed with the results compared to established sediment quality criteria. These results were used in normalizing laboratory test results into pollution indexes. The marinas were characterized via dimensionless numbers composed of several physical parameters indicative of the basin's geometry on which the flushing ability of estuarine and riverine enclosures might depend. From a general statistical examination of the benthic sediment quality data, models were developed representing sediment quality indexes and flushing phenomena. A nomogram for use in the design process for marine siting was developed. (NOAA) W78-07553

**WATER WELL SAMPLES MUST BE COLLECTED WITH CARE.**  
Johnson Drillers Journal, Vol. 50, No. 2, p 10, March-April, 1978. 1 tab.

Descriptors: \*Water wells, \*Water sampling, \*Water analysis, \*Bacteria, \*Methodology, \*Disinfection.

Water samples frequently are required by state health departments for new and reconditioned wells; special care must be taken to prevent contamination that can effect the bacteriological examination of the sample. Well cleaning and disinfection must precede the sampling, the pump and connections also being disinfected should the sample be taken after the pump is installed. The sample should be taken as close to the well as possible to avoid picking up any bacteria from the piping system, and never taken from hoses as they are impossible to disinfect. The faucet or tap should be flamed before sampling, and the water let run for at least three minutes. The sampling bottle should not be rinsed, but simply filled continuously to about 1/2 inch below the threads. The inside of the cap and the threads should not be touched, and it is best not to set the cap down anywhere when filling the bottle. Sampling should be scheduled between Monday and Thursday so it can arrive at the laboratory by mail within 30 hours. (Eberle-NWWA) W78-07584

**OZONATION OF COAL GASIFICATION PLANT WASTEWATER.**  
Pittsburgh Univ., PA. Dept. of Civil Engineering. R. D. Neufeld, and A. A. Spinola. Environmental Science and Technology, Vol 12, No 4, p 470-472, April, 1978. 2 fig, 3 tab, 5 ref.

Descriptors: \*Ozone, \*Phenols, \*Chemical wastes, \*Industrial wastes, \*Oxidation, \*Pollutant identification, \*Analytical techniques, \*Pilot plants, \*Air pollution, \*Chemical reactions, \*Nitrogen compounds, \*Organic compounds, \*Waste water treatment, \*Gas chromatography.

Laboratory experiments were used to examine the characteristics of liquid wastes from the Synthane coal gasification process and to evaluate high-rate ozonation for treatment of these wastes. Gas chromatography, atomic absorption, and wet chemical analyses indicated that Synthane wastes were high in total organic carbon, alkalinity, simple phenol, and polydric phenolics. The ozonation studies

used a 30-inch high, 2.75-inch diameter counter-current packed absorption tower to contact waste water introduced at a rate of 1 liter/min with a gas stream containing 74 mg/liter ozone. Decreasing waste to ozone ratios increased the concentration of low boiling components measured as acetone, methanol, and benzene. This was attributed to byproduct partial oxidation of the more complex polydric phenols to yield simpler compounds. Thiocyanate levels were reduced from 445 to 240 mg/liter; cyanide levels increased from 1 to 10 mg/liter. (Schulz-FIRL) W78-07589

**A TEST AND A TECHNIQUE FOR PREDICTING BODS VALUES OF KRAFT MILL WASTE.**  
Federal Paper Board Co., Riegelwood, NC. T. B. Douglas. Tappi, Vol. 61, No. 4, p 53-56, April, 1978. 4 fig, 1 tab, 24 ref.

Descriptors: \*Pulp and paper industry, \*Pulp wastes, \*Biochemical oxygen demand, \*Iodine, \*Analytical techniques, \*Alkalinity, \*Sodium compounds, \*Lignins, \*Volumetric analysis, \*Pollutant identification, \*Waste water treatment, \*Industrial wastes.

A sodium hypiodite oxidation procedure can predict BOD concentrations in treated kraft paper mill waste water within a short time period. A 500 ml waste sample cooled to 20°C is mixed with 1 ml of 50% NaOH and 50 ml of 0.100N I<sub>2</sub> and incubated for 1 hr. After sulfuric acid addition and titration, the BOD is predicted according to the amount of iodine consumed by the waste during the alkaline reaction. The alkaline iodine decomposes to NaI and NaIO<sub>3</sub> within 2 hrs. Secondary alcohols are oxidized to methyl ketones in the alkaline iodine reaction; the reaction also oxidizes other alcohols, aldehydes, ketones, and unsaturated compounds without destroying all organic substances. When NaOH was used to maintain the pH at 12.0, the alkaline iodine analysis of predictive BOD yielded a 0.953 correlation coefficient with standard BOD calculations in the range of 0-100 ppm. Lignins or turpentine which interfere with standard BOD measurements have less of an impact on the predictive BOD method because microorganisms are not a factor in the calculations. Further research is recommended to assess the interference of turpentine in the measurement of oxidizable substances. The accuracy of the three-day predictive BOD analysis was verified over a four-year testing program at the Federal Paper Board Co in Riegelwood, North Carolina. (Lisk-FIRL) W78-07597

**CHLORINATED HYDROCARBONS IN MACROINVERTEBRATES AND FISH FROM THE LOWER MEDWAY ESTUARY, KENT.**  
John Cass Coll., London (England). For primary bibliographic entry see Field 5C. W78-07661

**A PRELIMINARY STUDY OF THE USE OF BENTHIC ALGAE AS BIOLOGICAL INDICATORS OF HEAVY METAL POLLUTION IN SORFJORDEN, NORWAY.**  
Central Inst. for Industrial Research Oslo (Norway). A. Melhuus, K. L. Seip, and S. Myklestad. Environmental Pollution, Vol. 15, p 101-107, 1978. 1 fig, 5 tab, 15 ref.

Descriptors: \*Zinc, \*Copper, \*Lead, \*Cadmium, \*Sea water, \*Benthic flora, \*Heavy metals, \*Absorption, \*Algae, \*Bioindicators, \*Pollutant identification, \*Marine algae, \*Path of pollutants, \*Fucus, \*Ascomycellum, \*Bioaccumulation, \*Tissue analysis, \*Sorfjorden(Norway).

Concentration of zinc, copper, lead and cadmium in seawater and in some benthic algae are re-

ported. The concentration factors for *Fucus vesiculosus* and *Ascomycellum nodosum* are in good agreement with values given by other authors, even though the zinc concentrations are about ten times larger than those found in most previous work. The concentrations are about ten times larger than those found in most previous work. The concentration factors obtained for zinc and cadmium are essentially the same in the whole area; however, for copper and lead the values decrease towards the mouth of the fjord. (Deal-EIS) W78-07665

**A FIVE-YEAR MONITORING STUDY OF THE CHLORINATED HYDROCARBONS IN THE FISH OF A FINNISH LAKE ECOSYSTEM.**  
Jyväskylä Univ. (Finland). M. L. Hattula, J. Janatuinen, J. Sarkka, and J. Passivirta. Environmental Pollution, Vol. 15, p 121-138, 1978. 4 fig, 6 tab, 29 ref.

Descriptors: \*Chlorinated hydrocarbon pesticides, \*Polychlorinated biphenyls, \*Pesticide residues, \*DDT, \*Aldrin, \*Dieldrin, \*DDD, \*DDE, \*Perches, \*Pikes, \*Path of pollutants, \*Water pollution sources, \*Freshwater fish, \*Bioaccumulation, \*Tissue analysis, \*Lindane, \*Bream, Finland, Lake Päijänne.

The present study concerns the content of PCB- and DDT-related compounds in Finnish inland water fish. During five years 1723 specimens and twelve species were analysed, the material being obtained from Lake Päijänne, the second largest lake in Finland. The lake consists of five limnologically different areas. The results showed that the average PCB concentrations mg/kg on a wet weight basis was 0.056 and sigma DDT (DDT + metabolites) 0.010, respectively. The concentrations of lindane, aldrin, and dieldrin were under 0.0005 mg/kg. The differences between the species were greater than those between the areas. (Deal-EIS) W78-07667

**INVESTIGATION OF REMOTE WATER-QUALITY MONITORING SYSTEMS FOR USE WITH GOES OR ERTS WATER DATA TRANSMITTER.**  
Army Engineer Waterways Experiment Station, Vicksburg, MS. A. W. Ford. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A04795. Price codes: A03 in paper copy, A01 in microfiche. Technical Report Y-77-5, November 1977. 46 p, 14 fig, 5 tab.

Descriptors: \*Monitoring, \*Water quality, \*Remote sensing, \*Satellites(Artificial), \*Transmitters, \*Pollutant identification.

A field demonstration was implemented to deploy under actual field conditions several water-quality monitoring systems to determine their overall suitability and compatibility with the LaBarge designed remote water data transmitter. In addition, the study was to establish an information base upon which decisions could be made for selecting water-quality monitoring equipment capable of gathering reliable data for extended periods with limited maintenance. Results of the investigation revealed that in long-term unattended situations, equipment operation was unsatisfactory. But in short-term deployments with sufficient attention being given to calibration techniques, the equipment rendered satisfactory results. The operational environment has a significant effect on data reliability and equipment maintainability. Even though the data were inconclusive, there were indications that turbidity and water temperature and currents affected the accuracy of the measurements. (WES) W78-07678

## 5B. Sources Of Pollution

## THE RELATIONSHIP OF LAKE QUALITY TO SPECIFIC URBANIZATION STRESSES,

Massachusetts Univ., Waltham. Dept. Environmental Sciences.  
For primary bibliographic entry see Field 5C.  
W78-07204

## WATER QUALITY MODEL FOR THE UPPER NORTH PLATTE RIVER,

Wyoming Univ., Laramie. Water Resources Research Inst.  
F. D. Rinehart, and R. D. Kerr.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 595, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Series No. 72, Completion Report, March 1978. 55 p, 4 fig, 42 ref. OWRT A-016-WYO(1), 14-31-0001-4051, 5051.

Descriptors: \*Simulation analysis, \*Water quality control, Water quality, \*Salinity, Water resources, Management, \*Wyoming, Model studies, Data collections, \*Dissolved solids, Path of pollutants, Water pollution, \*North Platte River(Wyo).

From the results of a field data survey and a literature search, total dissolved solids were chosen as the only pertinent modelable water quality parameter applicable to the upper North Platte River in Wyoming. Methods were developed to prepare published data for application to an existing salinity model which was used to simulate present conditions and can be used to simulate the impact of future development of the North Platte River.  
W78-07206

## AN ANALYTICAL EVALUATION OF THE UTILIZATION AND MANAGEMENT OF WATER RESOURCES IN THE LAKE METIGOSHE WATERSHED, NORTH DAKOTA,

North Dakota State Univ., Fargo. Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W78-07209

## THE EFFECTS OF DIURNAL MIXING ON THERMAL STRATIFICATION OF STATIC IMPOUNDMENTS,

Auburn Univ., AL. Dept. of Mechanical Engineering.  
For primary bibliographic entry see Field 2H.  
W78-07210

## THE EFFECT OF THE IONIC COMPOSITION OF THE ENVIRONMENT ON OXYGEN EXCHANGE IN THE ALGA ACETABULARIA (IN RUSSIAN),

Dnepropetrovskii Khimiko-Tekhnologicheskii Inst. (USSR).  
For primary bibliographic entry see Field 5C.  
W78-07213

## NITROGEN TRANSFORMATIONS IN LAND TREATMENT,

Massachusetts Univ., Amherst. Dept. of Civil Engineering.  
F. A. DiGiano, and Y-S. Su.  
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 103, No. EE6, p 1075-1087, December, 1977. 4 fig, 1 tab, 21 ref, 1 append. OWRT B-033-MASS(2) and B-038-MASS(2).

Descriptors: \*Nitrogen, \*Chlorophyll, \*Return flow, \*Nitrates, \*Dissolved oxygen, Storage tanks, Rates of application, Model studies, Recirculated water, Waste water treatment.

The nitrogen transformations occurring in an aerobic waste water storage basin before land application were measured in studies with an experimental waste water lagoon and simulated with a biological model. The biological model was based on the ratio of cellular nitrogen to chlorophyll as a function of the inorganic nitrogen concentration. Variations in radiation, temperature, and waste water properties are taken into account. The experimental aerobic storage lagoon collected waste water during three winter months at a rate of 6 gal/day. A fill-and-draw procedure was used to simulate land application treatment over a nine-month period. Daily measurements of dissolved organic nitrogen, algal cells, pH, temperature, dissolved oxygen, total organic carbon, ammonia, and nitrate were recorded. A significant reduction in the concentration of chlorophyll-A per cell and in the cellular nitrogen to chlorophyll-A ratio was observed during July and August. A comparison of model predictions and experimental lagoon measurements for concentrations of chlorophyll-A, organic nitrogen, ammonia-nitrogen and nitrate-nitrogen revealed similarities. The observed nitrogen concentrations were then examined with respect to the effects of spray irrigation on crops, land area, and hydraulic application rate of effluent. The inorganic nitrogen concentration decreased during June and July when rates of nitrogen uptake by plants increased. It was suggested that applications of unstored secondary effluent be combined with stored effluent to ensure adequate nitrogen levels. (Lisk-FIRL)  
W78-07216

## HYDRAULIC MODELING OF MIXING IN STRATIFIED LAKES,

Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.  
P. M. Moretti, and D. K. McLaughlin.  
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. 4, p 367-380, April 1977. 14 fig, 1 tab, 11 ref, 2 append. OWRT A-064-OKLA(2).

Descriptors: \*Hydraulic models, \*Mixing, \*Ham's Lake(OK), \*Destratification, \*Flow characteristics, Pumps, Propellers, \*Oklahoma, Stratification, Model studies, Lakes, Stratified flow, Water temperature, Density, Artificial destratification, Scale distortion.

A model of stratified lake flows to predict prototype mixing phenomena was developed for use in studies of mechanical destratification of certain Oklahoma lakes. Ham's Lake, Oklahoma, on which the model is based, has been artificially destratified annually with a 1.07-m-propeller pump. Scale factors of 1:360 horizontally and 1:34 vertically were employed; for Reynolds number considerations, such scale distortion is necessary in all but the largest lake models. Although a vertically-exaggerated model of a stratified lake flow apparently cannot duplicate all the details of the mixing process, vertical dispersion alone can be accurately modelled in a distorted model of inflow in a stratified basin if the overall Richardson number,  $J$  sub 1 =  $g \Delta \rho H / \rho U$  squared is used as the modelling parameter. Horizontal dispersion can be accurately modelled if  $J$  sub 2 =  $g \Delta \rho h w$  squared /  $\rho U$  squared  $H$  is used as the basic modelling parameter. Surprisingly accurate modelling of the prototype destratification experiments using the mechanical pump was achieved. The appropriate nondimensional parameter was the overall Richardson number,  $J$  =  $g \Delta \rho H / \rho U$  squared, and the characteristic time used to nondimensionalize the mixing times was the volume of the lake divided by the volume flow rate of the pump. Major features of the model experiment were: (1) strong initial stratification, (2) vertical scale exaggeration, and (3) the pump and its near flow field were not distorted. (Lynch-Wisconsin)  
W78-07218

## STABLE NITROGEN-CONTAINING DISSOLVED ORGANIC SUBSTANCE IN LAKE SCHOEHEE AND IN CULTURES OF ALGAE (IN GERMAN),

Bayerische fuer Landesamt Wasserwirtschaft, Munich (West Germany).  
C. Steinberg.  
Arch Hydrobiol Supplementb 53(1), p 48-158, 1977.

Descriptors: \*Organic matter, Distribution, Path of pollutants, Lakes, \*Lake Schoehsee(West Germany), \*Amino acids, \*Bacteria, \*Nutrients, Peptides, Proteins, Scenedesmus-quadracauda.

In the slightly productive Lake Schoehsee (Holstein, northern Germany) the mean concentrations of dissolved proteins, peptides and free amino acids ranged from 65 to 80 micro-amino-N/l. In the uppermost water-layer, the maximum concentrations were related primarily with phytoplankton fluctuations during stratification. Free dissolved amino acids shared 6-10% of the proteinaceous N only. Fractionations of the ninhydrin-positive matter by ultrafiltration showed the main molecular weight fraction to be peptides smaller than MW 10,000 covering about 60% of the proteinaceous N. Gel-filtration proved that 55-60% of the peptides do not exceed MW 1500. The distribution-patterns derived by the fractionations seemed to be characteristic of the aquatic ecosystem studied. The distribution of the organic and proteinaceous matter and of the trace elements indicate chelate-complexes of these substances. In a culture with enriched organic matter of Lake Schoehsee bacteria did not utilize more than 33% of the substances. The mentioned chelate-complexes and limitations of the heterotrophic activity by lack of organic nutrients are thought to be the main reasons for the stability of the substances studied. Relatively high concentrations of proteinaceous matter accumulated in a bacteria-free culture of Scenedesmus quadracauda. After contamination high concentrations of proteins and peptides resisted microbial degradation. These limitations of the biodegradation process could partly be stopped by adding large amounts of organic nutrients.—Copyright 1978, Biological Abstracts, Inc.  
W78-07260

## NITROGEN TRANSFORMATION IN LAKES, Danish Soil Conservation Service, Viborg, Research Dept.

For primary bibliographic entry see Field 5C.  
W78-07262

## IBM 1130 COMPUTATION PROCESS IN THE STUDY OF BIOPHYSICAL CONSTANTS VARIATIONS OF PATHOGENOUS BACTERIA BY PHYTOPLANKTON,

Santiago Univ. (Spain). Dept. of Microbiology.  
For primary bibliographic entry see Field 5C.  
W78-07264

## INVESTIGATION OF OIL POLLUTION ON THE POLISH BALTIC COAST IN 1974/1975 (IN POLISH),

Wyższa Szkoła Pedagogiczna, Gdansk (Poland). Inst. of Biology.  
W. Gorski, B. Jakuczun, C. Nitecki, and A. Petryna.  
Przegl Zool 21(1), p 20-23, 1977.

Descriptors: \*Oil pollution, \*Baltic Sea coast(Poland), Water pollution sources, \*Poland, \*Water birds, Water pollution effects, Clangula-hyemalis, Larus-argentatus, Larus-ridibundus, Melanitta-fusca, Melanitta-nigra, Podiceps-cristatus.

Investigations were carried out from Nov. 1974-Aug. 1975 on the Polish Baltic Coast (205 km). The material contained 667 dead water birds from 20 spp. The most numerous species were: Clangula



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

hyemalis (46.8%), *Melanitta fusca* (15.2%), *Melanitta nigra* (10.4%), *Larus argentatus* (5.6%), *Podiceps cristatus* (5.1%) and *Larus ridibundus* (5.1%). The mean number of dead birds for 1 km of the coast was 3.2. This number was lower than in the previous years. The highest number of dead birds was found in March and April (42.3%). Many birds, (82%) had oiled plumage. The investigation will be continued.—Copyright 1978, Biological Abstracts, Inc. W78-07265

**MERCURY POLLUTION OF WATER (IN BULGARIAN),** Academy of Medicine, Sofia (Bulgaria). Inst. of Hygiene and Occupational Diseases; and Academy of Medicine, Sofia (Bulgaria). Inst. of Nutrition. M. Moneva, and S. Voinova. Khig Zdraveopaz 19(5), p 494-496, 1976.

Descriptors: \*Mercury, \*Water pollution sources, Industrial wastes, Agricultural wastes, Water pollution control, Bird, Fish, Mining wastes.

A brief review of studies from different countries indicated that the Hg level in surface and ground waters has detectably increased. This pollution, arising from various mining, industrial and agricultural sources, poses a definite threat to both humans and animals, particularly fish and birds. Control measures are necessary.—Copyright 1978, Biological Abstracts, Inc. W78-07268

**ANNUAL FLUCTUATIONS IN BIOMASS OF TAXONOMIC GROUPS OF ZOOPLANKTON IN THE CALIFORNIA CURRENT,** Plymouth (England). Institute for Marine Environmental Research, Plymouth (England). For primary bibliographic entry see Field 5C. W78-07275

**ROLE OF PLANKTON IN THE BEHAVIOR OF TC99 AND MN54 IN SEAWATER,** For primary bibliographic entry see Field 5C. W78-07286

**LAND USE AND POLLUTION PATTERNS ON THE GREAT LAKES,** Cold Regions Research and Engineering Lab., Hanover, NH. R. K. Haugen, H. L. McKim, and T. L. Marlar. Available from the National Technical Information Service, Springfield, VA 22161 as N77-21514. Price codes: A12 in paper copy, A01 in microfiche. NASA-CR-152641, Final Report, April 1972-March 1975. 89 p, 23 fig, 12 tab, 21 ref, 3 append. NASA SR/T 160-75-89-05-10.

Descriptors: \*Land use, \*Remote sensing, \*Suspended solids, \*Wisconsin, \*Aerial photography, Manitowoc River(WI), East Twin River(WI), Oconto River(WI), Multispectral scanners, Infrared film, Thermal scanners, Microwaves, Mapping Satellites, Sediments, Lake Michigan, Great Lakes, Water pollution sources, Radiometers.

Use of remote sensing data for regional assessment of the effect of land use on stream sediment loading was evaluated in terms of economy and speed, incorporating data from three major watersheds in eastern Wisconsin. The most useful imagery supplied by NASA was high altitude color infrared with 9-inch format RC-8 and Zeiss cameras. This combination was judged adequate for any regional land use mapping to level II of the USGS land use classification; with ground truth support, level III detail is feasible. The study comprised the Manitowoc, East Twin, and Oconto River watersheds. High altitude (60,000 ft) aerial imagery was evaluated for: (1) color, (2) color infrared, (3) multispectral black and white, and (4)

thermal. Low altitude (less than 5000 ft) imagery included: (1) color infrared, (2) multispectral black and white, (3) thermal, and (4) passive microwave. A non-imaging hand-held four-band radiometer was also tested for acquiring suspended sediment data. Suspended sediment loads in streams were determined from water samples, and were related to land use and soil types. The study was initiated in April 1972, and NASA imagery was provided in September 1972. A system of densitometric measurement with hand-drawn overlay maps was developed and provided data for subsequent comparisons with water quality parameters. The data gathered is presented in tables. (Lynch-Wisconsin) W78-07288

**COPEPOD4: A DISCRETE TIME-DELAY MODEL OF COPEPOD POPULATION DYNAMICS,** Oak Ridge National Lab., TN., Environmental Sciences Div. L. A. Maguire, S. R. Blum, C. W. Gehrs, and W. Van Winkle. Publication No. 882, July 1976. 109 p, 13 fig, 2 tab, 11 ref, 4 append. ORNL/TM-4977, W-7405-eng-26.

Descriptors: \*COPEPOD4, \*Model studies, \*Computer programs, \*Copepods, \*Zooplankton, \*Life cycles, Population, Mathematical models, Life history studies, Egg production, Time delays, Growth stages, Diaptomus clavipes, Oklahoma, Instars, Seasonal, Ponds.

COPEPOD4, a time-delay model for copepod population dynamics, is an alternative formulation to COPEPOD2, described in an earlier report. Both models represent the same biological system and address the same major objectives; only COPEPOD4 includes adult age structure, and must be used if the effects of changes in adult lifespan or age-specific adult mortality patterns are to be explored. COPEPOD4, however, assumes constant instar durations, whereas COPEPOD2 does not. Input for COPEPOD4 is simpler than for COPEPOD2, but although equations and the system diagram appear simpler, use of time-delay equations actually makes COPEPOD4 more complicated and more difficult to modify. Both models were derived from data gathered during a one-year field study of *Diaptomus clavipes* in a small pond in Oklahoma. COPEPOD4 includes compartments representing numbers of subitaneous eggs, resting eggs, juveniles (nauplii and copepods), and adults. Instar durations are represented using difference equations with constant time delays, and durations must thus be assumed constant. In the constant parameter version of COPEPOD4, clutch size and survival are also assumed constant. Events in the annual life cycle, such as resting egg production, are modeled as functions of season rather than as responses to environmental variables such as water temperature or food. The model could be adapted to non-copepod populations where different life stages must be represented. (Lynch-Wisconsin) W78-07289

**A GENERALIZED WATER QUALITY MODEL FOR EUTROPHIC LAKES AND RESERVOIRS,** Battelle Pacific Northwest Lab., Richland, WA. For primary bibliographic entry see Field 5C. W78-07290

**MARINE POLLUTION HAZARDS,** Southern California Univ., Los Angeles. Dept. of Biological Sciences. For primary bibliographic entry see Field 5C. W78-07297

**THE RELATION BETWEEN ADENOSINE TRIPHOSPHATE AND MICROBIAL BIOMASS IN DIVERSE AQUATIC ECOSYSTEMS,** California Univ., Davis. Div. of Environmental Studies.

For primary bibliographic entry see Field 5C. W78-07306

**SEDIMENTARY RECORD OF HEAVY METALS AND POLYCYCLIC AROMATIC HYDROCARBONS IN LAKE CONSTANCE (IN GERMAN),** Heidelberg Univ. (West Germany). Lab. fuer Sedimentforschung. G. Mueller, G. Grimmer, and H. Boehnke. Naturwissenschaften 64(8), p 427-431, 1977.

Descriptors: \*Heavy metals, \*Aromatic compounds, Lakes, \*Lake Constance(West Germany), Lake sediments, Water pollution sources, \*Coals, \*Polycyclic aromatic hydrocarbons.

The enrichment of heavy metals and polycyclic aromatic hydrocarbons (PAH) in dated sediments from Lake Constance during the past 75 yr corresponds to the general increase of European coal consumption within the same period of time. Coals are assumed to be the main source of heavy-metal enrichment; incomplete combustion (pyrolysis) of coal also seems to be responsible for the very sharp increase of PAH.—Copyright 1978, Biological Abstracts, Inc. W78-07307

**SUMMARY REPORT - THE CHOWAN RIVER PROJECT,** North Carolina Water Resources Research Inst., Raleigh. For primary bibliographic entry see Field 5C. W78-07318

**THE ROLE OF SURFACE MICROLAYER OF WATER IN THE DISTRIBUTION AND FATE OF TRACE ORGANIC CONTAMINANTS; A FEASIBILITY STUDY,** Missouri Univ.-Rolla. Dept. of Chemistry. J. F. Stampfer, and D. V. Roach. Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 749. Price codes: A02 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, Rolla, Completion Report, April 1978. 14 p, 5 fig, 1 tab, 11 ref. OWRT A-098-MO(1), 14-31-0001-7053.

Descriptors: \*Aerosols, Isotope enrichment, \*Trace organic contaminants, Surface microlayer, \*Path of pollutants, \*Organic wastes, \*Pollutant identification, Distribution, \*Air pollution.

The transport of materials from the water surface to aerosols produced by bursting bubbles was investigated. When the bubbles break rapidly upon reaching the surface no net concentration effect is found, indeed the concentration of materials in the jet drops is usually less than that of the solution. When the bubbles reside on the surface before breaking, a concentration of the surface materials is noticed in the jet drops. The amount present can be up to 15 times the amount present in the same volume of solution.  $32\text{PO}_4$  and  $33\text{PO}_4$  do not seem to be transported equally into the aerosols. W78-07319

**RADIONUCLIDE CONCENTRATIONS IN THE ARKANSAS RIVER UPSTREAM AND DOWNSTREAM FROM THE NUCLEAR 1 POWER GENERATING FACILITY,** Arkansas State Univ., University. Dept. of Physical Sciences. D. M. Chittenden, II.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 808. Price codes: A03 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Technical Completion Report, 1978. 27 p, 2 fig, 10 tab, 10 ref. OWRT A-037-ARK(1).

Descriptors: \*Arkansas River, \*Radioisotopes, \*Path of pollutants, Nuclear powerplants, Water pollution sources, \*Dardenele Lake(Ark), Lakes.



Lake sediments, Absorption, Pollutant identification, Radiochemical analysis.

The main thrust was to determine the increase in the concentration of the radionuclides as a result of reactor operations as a function of their distance from the source. Overall, it was concluded that the day-to-day operation of Nuclear I has very little effect on the radionuclide concentration in Dardanelle Lake Water. The fallout from the Chinese nuclear test in 1976 was more evident. Only planned releases caused significantly increased concentrations. Dilution by river water may not have been as effective as could be wished, but this may have been a seasonal effect. The slow turnover of lake water during dry periods also posed a problem because of the spread of reactor-produced nuclides throughout the lake. At no time did the concentrations of the measured nuclides exceed the limits set by the Arkansas State Department of Health. Concentration were so low that it was decided not to pursue a study of the uptake of radionuclides in biological systems or in their deposition with sediments. (Smiley-Ark) W78-07320

#### POLLUTION IN THE NORTHEAST PACIFIC OCEAN,

National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center. N. L. Karrick, and E. H. Gruger, Jr. Marine Fisheries Review, Vol. 38, No. 11, November 1976, p. 2-19, 2 fig, 3 tab, 64 ref.

Descriptors: \*Pacific Ocean, \*Water pollution sources, \*Water pollution effects, \*Pollutants, \*Pacific Northwest U.S., \*Waste disposal, Oceans, Sublethal effects, Lethal limit, Toxins, Path of pollutants, Coasts, Pacific coast region, Oregon, Washington, Alaska, Environmental effects.

The relative freedom from pollution in the northwest Pacific Ocean has been an accident of geography and timing, especially a lower rate of industrialization and settlement than on other U.S. coasts. Other important factors are the prevalence of on-shore winds and currents and the relatively narrow continental shelf with sharp dropoff. Emphasis in this report is directed toward use of coastal waters of northwestern North America for disposal of wastes from domestic, industrial, and agricultural activities, and toward criteria for evaluating effects on marine life. The following topics are addressed: (1) environmental factors, including physical environment, oxygen levels, temperature, and salinity; (2) contaminants, including physical transport, distribution, and toxicology (acute lethal and chronic sublethal effects); (3) short- and long-term effects of pollutants on marine life; and (4) contaminants discharged into the northeast Pacific, including domestic wastes (effluents, bacteria, viruses), and industrial wastes (timber industry, logging, forest products, agriculture, food processing, aluminum production, metals, chloralkali plants, petroleum refining and drilling, nuclear plants). A table shows sources and characteristics of contaminants to the area. The existence of pollution is evidenced by contaminated estuaries and levels of chlorinated hydrocarbons, such as DDT and PCBs, in the fat of marine mammals. (Lynch-Wisconsin) W78-07325

#### MISSOURI RIVER BASIN STEROL ASSAY PROJECT REPORT. COPROSTANOL, A POSITIVE MARKER OF DOMESTIC AND RUN-OFF POLLUTION: STEROL ASSAY OF WASTEWATER PLANT EFFLUENTS AND SURFACE WATERS OF THE LOWER MAIN STEM MISSOURI,

National Environmental Research Center, Cincinnati, OH. Advanced Waste Treatment Research Lab. For primary bibliographic entry see Field 5A. W78-07328

#### MISSISSIPPI RIVER BASIN STEROL ASSAY PROJECT REPORT. COPROSTANOL, A POSITIVE MOLECULAR MARKER OF DOMESTIC AND RUN-OFF SEWAGE, WASTEWATER PLANT EFFLUENT AND SURFACE WATERS IN THE BURLINGTON, IOWA AREA ON THE MISSISSIPPI RIVER,

National Environmental Research Center, Cincinnati, OH. Advanced Waste Treatment Research Lab. For primary bibliographic entry see Field 5A. W78-07329

#### ANALYSIS OF VARIOUS IOWA WATERS FOR SELECTED PESTICIDES: ATRAZINE, DDE, AND DIELDRIN--1974,

Atomic Energy Commission, Ames, IA. For primary bibliographic entry see Field 5A. W78-07331

#### DETECTION OF NONPOINT POLLUTION OF SMALL STREAMS IN SOUTHWESTERN CONNECTICUT,

Fairfield Univ., CT. Dept. of Biology. For primary bibliographic entry see Field 5A. W78-07334

#### URBAN RUNOFF POLLUTION CONTROL--STATE-OF-THE-ART,

Meta Systems Inc., Cambridge, MA. For primary bibliographic entry see Field 5G. W78-07335

#### URANIUM-ISOTOPE VARIATIONS IN GROUNDWATERS OF THE FLORIDAN AQUIFER AND BOULDER ZONE OF SOUTH FLORIDA,

Florida State Univ., Tallahassee. Dept. of Geology; and Geological Survey, Tallahassee, FL. Water Resources Div. J. B. Cowart, M. I. Kaufman, and J. K. Osmond. Journal of Hydrology, Vol 36, p 161-172, 1978. 4 fig, 1 tab, 18 ref.

Descriptors: \*Uranium radioisotopes, \*Florida, \*Aquifers, \*Groundwater movement, \*Path of pollutants, Chemical reactions, Waste disposal wells, Injection wells, Investigations, Aquifer characteristics, Transmissivity, Saline water intrusion, Evaluation, \*U-234/238 alpha-activity ratio, \*Floridan aquifer, Southern Florida.

Water samples from four wells from the main Floridan aquifer (300-400 m below mean sea level) in southeast Florida exhibit U-234/U-238 activity ratios that are significantly lower than the secular equilibrium value of 1.00. Such anomalous values have been observed previously only in waters from sedimentary aquifers in the near-surface oxidizing environments. These four wells differ from six others, all producing from the same general horizon, in being located in cavernous highly transmissive zones. The low activity ratios are indicative of a relic circulation pattern whereby water from the surface aquifer was channelled to lower levels when sea level was much lower. At a deeper cavernous level, known as the Boulder Zone (800-1,000 m below mean sea level), the U isotopes, along with other chemical constituents, show progressive changes with increasing distance from an inferred flow source in the Straits of Florida. This tends to support the hypothesized landward flow (though with a more northerly component) of cold seawater in the extensively transmissive Boulder Zone. (Woodard-USGS) W78-07343

#### UNSTEADY-STATE WATER-QUALITY

MODEL, Geological Survey, Lakewood, CO. Water Resources Div.; and Geological Survey, Bay Saint Louis, MS. Water Resources Div. D. P. Bauer, and J. P. Bennett.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 336, Price codes: A06 in paper copy, A01 in microfiche. Computer Contribution report, August 1976. 110 p, 4 fig, 8 ref.

Descriptors: \*Computer programs, \*Model studies, \*Mathematical models, \*Unsteady flow, \*Streams, Analytical techniques, Equations, \*Water quality, Dissolved oxygen, Biochemical oxygen demand, Wastes, Inflow, Biological properties, Channel morphology, Streamflow.

The unsteady-state water-quality program is based on a one-dimensional mathematical model which predicts the stream response characteristics from waste source inputs. Variables which are predicted include dissolved oxygen and biochemical-oxygen demand. The program uses a convolution approach to solve the dissolved-oxygen balance and biochemical-oxygen demand equations. Longitudinal dispersion is, however, not considered in the program equations. The program uses a numerical integration technique for the solution of the model differential equations. The model formulation allows for unsteady-state conditions (varying flow rate and concentration for waste and stream). Some or all variables used by the model can be steady state. For a problem solution each reach of a stream system is broken into a given number of subreaches, generally at waste or tributary inflow points, or where there are changes in the stream geometry. All waste constituents are assumed to be completely mixed in the vertical and lateral directions of the channel at the point of waste addition to the stream. (Woodard-USGS) W78-07348

#### NITRIFICATION IN FOUR ACIDIC STREAMS IN SOUTHERN NEW JERSEY,

Geological Survey, Trenton, NJ. Water Resources Div. For primary bibliographic entry see Field 5C. W78-07353

#### THE USE OF GALERKIN FINITE-ELEMENT METHODS TO SOLVE MASS-TRANSPORT EQUATIONS,

Geological Survey, Denver, CO. Water Resources Div. D. B. Grove.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 532, Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 77-49, October 1977. 55 p, 14 fig, 2 tab, 51 ref.

Descriptors: \*Water pollution sources, \*Waste disposal wells, \*Path of pollutants, \*Model studies, \*Equations, Numerical analysis, Computer models, Mathematical models, Groundwater movement, Ion transport, Chemical reactions, Ion exchange, Water quality, \*Galerkin finite-element technique.

The partial differential equation that describes the transport and reaction of chemical solutes in porous media was solved using the Galerkin finite-element technique. These finite elements were superimposed over finite-difference cells used to solve the flow equation. Both convection and flow due to hydraulic dispersion were considered. Linear and Hermite cubic approximations (basis functions) provided satisfactory results; however, the linear functions were computationally more efficient for two-dimensional problems. Successive over relaxation (SOR) and iteration techniques using Tchebyscheff polynomials were used to solve the sparse matrices generated using the linear and Hermite cubic functions, respectively. Comparisons of the finite-element methods to the finite-difference methods, and to analytical results, indicated that a high degree of accuracy may be obtained using the method outlined. The technique was applied to a field problem involving an aquifer contaminated with chloride, tritium, and strontium-90. (Woodard-USGS)

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

W78-07354

#### ANALYSIS OF WASTE-LOAD ASSIMILATIVE CAPACITY OF THE YAMPA RIVER, STEAMBOAT SPRINGS TO HAYDEN, ROUTT COUNTY, COLORADO,

Geological Survey, Lakewood, CO. Water Resources Div., and Colorado Department of Health, Denver.

D. P. Bauer, T. D. Steele, and R. D. Anderson. Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 051. Price codes: A05 in paper copy, A01 in microfiche. Water-Resources Investigations 77-119, March 1978. 69 p, 39 fig, 8 tab, 38 ref.

Descriptors: \*Simulation analysis, \*Waste assimilative capacity, \*Model studies, \*Colorado, \*Rivers, \*Projections, Water quality control, Low-flow augmentation, Computer models, Methodology, Invertebrates, Nutrients, Benthos, Water treatment, Evaluation, Water pollution control, \*Yampa River basin (Colorado Wyo), \*Steamboat Springs (Colorado).

An analysis of the waste-load assimilative capacity of the Yampa River from Steamboat Springs to Hayden, Colo., a distance of 38 miles, was made during September 1975 to obtain information on the effects of projected waste loadings on this stream reach. Simulations of effects of waste loadings on streamflow quality were made using a steady-state water-quality model. The simulations were based on 7-day low-flow values with a 10-year recurrence interval and population projections for 2010. Model results for December and September streamflow conditions indicated that the recommended 1978 Colorado and 1976 U.S. Environmental Protection Agency water-quality standard of 0.02 milligram per liter for nonionized ammonia concentration would be exceeded. Model simulations also included the effect of a flow augmentation of 20 cubic feet per second from a proposed upstream reservoir. The permissible ammonia loading in the study reach could be increased approximately 25 percent with this amount of flow augmentation. Simulations of concentrations of dissolved oxygen, fecal coliform bacteria, and nitrate nitrogen indicated that the State's water-quality goals proposed for 1978, 1983, or 1985 would not be exceeded. (Woodard-USGS) W78-07356

#### PROTONATION OF ORGANIC BASES IN CLAY-WATER SYSTEMS,

Environmental Research Lab., Athens, GA. S. W. Karickhoff, and G. W. Bailey.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 258. Price codes: A02 in paper copy, A01 in microfiche. Report EPA-600/J-76-021, Reprint from: Clays and Clay Minerals, Vol 24, No 4, p 170-176, March 6, 1976. 6 fig, 3 tab, 21 ref.

Descriptors: \*Clays, \*Adsorption, \*Surfaces, \*Clay minerals, \*Soil surfaces, Chemical properties, Ions, Surface runoff, Surface waters, Interfaces, Soil types, Ion exchange, Physical properties, Agricultural runoff, Runoff, \*Surface chemistry, \*Surface acidity, \*Clay-water systems, \*Clay mineral surface acidity, Chemical behavior, Physical behavior, Pesticide behavior.

The extent of protonation of organic bases in clay-water systems depends upon the adsorptive properties of the organo-clay species involved and upon the structure and degree of hydration of the clay system. Organic molecules that can disperse cationic charge over two or more condensed aromatic rings give rise to greater surface-induced protonation than do single-ring organic molecules with similar solution pK<sub>sub</sub>a. Protonation in clay suspensions is frequently far in excess of that predicted on the basis of electrolytic suspension pH and solution pK<sub>sub</sub>a of the organic base. For a

given organic base, protonation in a clay film exceeds that in the suspended clay system. Protonation in an organo-clay film increases as the film moisture content decreased. The extent of protonation in organo-clay systems varies with cationic species, cationic saturation, and clay type. (Henley-ISWS) W78-07364

#### A SIMPLE MODEL FOR CROSS-SHELF MIXING ON THE SCOTIAN SHELF,

Dalhousie Univ., Halifax. (Nova Scotia) Dept. of Oceanography.

For primary bibliographic entry see Field 2L. W78-07366

#### DYE INFUSION TECHNIQUE ASSESSES STREAM POLLUTION IN OHIO,

Youngstown State Univ., OH. Dept. of Chemical Engineering.

L. V. Szirmay, R. T. Price, and P. L. Price. Water and Sewage Works, Vol. 125, No. 4, p 81-84, April 1978. 5 fig, 3 tab, 10 ref.

Descriptors: \*Water pollution, \*Ohio, \*Path of pollutants, \*Dye releases, \*Dye dispersion, Dye concentrations, Fluorescent dye, Dyes, Pollutants, Streams, Streamflow, Mixing, Dispersion, Model studies, Mathematical models, On-site data collections, Recreation facilities, Parks, \*Youngstown (Ohio).

Sodium fluorescein dye was used in moderate concentrations to simulate impulse inputs of pollutants into Bear's Den Run, a stream located in Mill Creek Park, in Youngstown, Ohio. From data collected, diffusion constants of an assumed distribution function were found ranging from 1.07 to 9.8 sq ft/sec. Diffusion coefficients, combined with the proper mathematical model, can be used to describe the pollution dispersion properties of a stream and to assess illegal discharge of pollutants from offenders. (Sims-ISWS) W78-07373

#### IMPACT OF A POWER PLANT ON THE GROUND-WATER SYSTEM OF A WETLAND,

Wisconsin Univ.-Madison. Dept. of Geology and Geophysics.

For primary bibliographic entry see Field 6G. W78-07377

#### DISPERSION IN SOIL COLUMNS: EFFECT OF BOUNDARY CONDITIONS AND IRREVERSIBLE REACTIONS,

Connecticut Agricultural Experiment Station, New Haven.

For primary bibliographic entry see Field 2G. W78-07386

#### TRAVEL OF MICROORGANISMS FROM A SEPTIC TILE,

ADI Ltd., Fredericton (New England).

For primary bibliographic entry see Field 5B. W78-07469

#### TRAVEL OF MICROORGANISMS FROM A SEPTIC TILE,

ADI Ltd., Fredericton (New England).

T. Viraraghavan. Water, Air, and Soil Pollution, Vol. 9, No. 3, p 355-362, 1978. 4 fig, 3 tab, 11 ref.

Descriptors: \*Septic tanks, \*Tile drains, \*Coliforms, \*Bioindicators, \*Groundwater movement, Base flow, Water levels, Water table, Water table aquifers, Adsorption, Filtration, Sewage bacteria, Streptococcus, Sampling, Waste water treatment, Domestic wastes.

The horizontal movement of indicator microorganisms from a septic tile drain in the direction of

groundwater flow was significantly affected by soil saturation levels. Water samples were obtained over a two-day period from a 7.93 m-long test tile using 2 m boreholes located 0, 3.05, 6.10, 9.15, 12.20, and 15.25 m downslope from the end of the septic tile. The groundwater samples were analyzed for coliforms, fecal coliforms, and fecal streptococci. The concentrations of the bioindicators decreased with distance from the septic tile drain. The groundwater level, which generally varied from 0-3.05 m, was 0.15 m below the septic tile at a depth of 0.6 m during the sampling period. Significantly high concentrations of the indicator microorganisms were found at a distance of 15.25 m. These were attributed to the high saturation level which limited vertical gravitations and allowed horizontal travel of the bioindicators by the groundwater flow. Results indicated that a vertical distance of 1.22 m would require a horizontal separation of not less than 30 m between the septic tile and a water source in a shallow aquifer for adequate adsorption and filtration of a sewage bacteria. (Lisk-FIRL) W78-07469

#### MONITORING IN THE ZONE OF AERATION, SCS ENGINEERS, LONG BEACH, CA.

For primary bibliographic entry see Field 5A. W78-07470

#### RECYCLING OF WATER FOR IRRIGATION: PERSISTENCE OF ENTEROVIRUSES IN SEWAGE EFFLUENT AND NATURAL WATERS RECEIVING THE EFFLUENT,

Hawaii Univ., Honolulu. Water Resources Research Center.

R. S. Fujioka, and P. C. Loh. Water, Air, and Soil Pollution, Vol. 9, No. 2, p 213-226, 1978. 5 tab, 21 ref. Water Resources Research Center Contribution 84.

Descriptors: \*Viruses, \*Activated sludge, \*Chlorination, \*Polyelectrolytes, \*Polymers, Analytical techniques, Sulfates, Cellulose, Membranes, Diseases, Return flow, Bodies of water, Waste water treatment, Municipal wastes.

Human enteroviruses were isolated in raw sewage, activated sludge, and chlorinated effluent from an Oahu treatment plant used to irrigate a two-year sugarcane crop, and in several samples from streams and Pearl Harbor, Hawaii. The sewage samples were concentrated by polyelectrolyte 60 (PE-60), polymer two-phase aluminum hydroxide, and protamine sulfate methods of enterovirus adsorption. Viruses were recovered from samples of river and harbor water by filtration through a cellulose membrane. Concentration of the chlorinated effluent yielded a 36% virus recovery by the PE-60, 68% by the polymer, 44% by aluminum hydroxide, and 3% by the protamine sulfate. The cellulose membrane recovered 38% of the enterovirus from receiving waters. The removal percentage from the samples were relatively high, although recovery rates were less efficient. Other viruses isolated in the waste water effluent included: coxsackievirus B-4, and B-5; echovirus-1, 7, and 27; reovirus; and poliovirus-1, 2, and 3. Poliovirus strains 1 and 3 were isolated in the water samples from the streams and harbor. Although the treatment methods at the Oahu plant removed about 90% of the human enteric viruses from the wastes, infectious viruses were still evident in the treated effluent and receiving waters. (Lisk-FIRL) W78-07471

#### SUBMISSION BY THE INSTITUTE OF WATER POLLUTION CONTROL TO THE ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION ON 'ENVIRONMENTAL POLLUTION AND AGRICULTURE'.

Water Pollution Control, Vol. 76, No. 4, p 505-510, 1977. 1 fig, 3 tab, 17 ref.

Descriptors: \*Sludge disposal, \*Nitrogen, \*Phosphorus, \*Water runoff, \*Water treatment, \*Wastes.

Water pollution supplies control sources are treated and method of chemical control. An estimated agricultural fertilizers applied by the sludge. Limit discharged in boron because and potential sources of water pollution. trichlorobenzene can contribute organic nitrogen farm wastes. W78-07473

#### EFFLUENT RIVER,

Minnesota Univ., Minneapolis. Mineral Engineering, H. Stefan, at Journal of Pollution, American Chemical Society, 104, No. 1, p 213, April 1978.

Descriptors: \*Mixing, \*Streams, \*Discharge, \*Waste disposal, \*Pollutants, \*Plumes.

A case study in water pollution very shallow inum length in zone water ratio, discharge parameters. data were not given in cities these relationships and discharge by for a given structure construction was advocated and operation and outfall and part of an effluent W78-07483

#### SALT LOAD FIELD STUDY

Golden and J. W. Rowe. Journal of Pollution, American Chemical Society, 104, No. 1, p 338, April 1978.

Descriptor: River, \*Comments, \*Coastal, \*Salt loading, \*Salt loading assessment.

Salt loading lands disturbed nearly 3 watersheds loading was

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Sources Of Pollution—Group 5B

Descriptors: \*Farm wastes, \*Fertilization, \*Sludge disposal, \*Spraying, \*Sprinkler irrigation, Nitrogen, Phosphorus, Sewage sludge, Agricultural runoff, Fertilizers, Water pollution, Waste water treatment, Waste water disposal, Municipal wastes.

Water pollution in agricultural areas and water supplies contributed by farm wastes and other sources are examined. Farm land application of treated and untreated sewage sludge is a suitable method of fertilization when the microbial and chemical contents of the sludges are monitored. An estimated 4% of the nutrients required for agricultural fertilization in England could be supplied by the phosphorus and nitrogen values in sludge. Limitations are recommended for levels discharged into the receiving soils of metals and boron because of their phytotoxic characteristics and potential harm to the food chain. Other pollution sources in agricultural land are spray irrigation water containing chloride, boron, salts, trichlorobenzoic acid, and cadmium. Agriculture can contribute to water pollution by leaching of inorganic nitrogen and other fertilizers, and organic farm wastes. (Lisk-FIRL)  
W78-07473

**EFFLUENT MIXING ZONE IN A SHALLOW RIVER.**  
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.  
H. Stefan, and J. S. Gulliver.  
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE2, Proceedings Paper 13678, p 199-213, April 1978. 9 fig, 14 ref, 2 append.

Descriptors: \*Thermal pollution, \*Effluents, \*Mixing, \*Rivers, Cooling water, Heated water, Streams, Temperature, Water temperature, Discharge(Water), Outlet works, Turbulence, Waste disposal, Water pollution, Water quality, Pollutants, Path of pollutants, Plumes, Thermal plumes.

A case study was made for a low momentum cooling water plume discharged from the shore into a very shallow river. The maximum width, a maximum length, and enclosed surface areas of a mixing zone were determined as a function of dilution ratio, discharge to river flow ratio, and weather parameters. Theoretical results and extensive field data were reduced to dimensionless relationships given in either graphical or analytical form. From these relationships, appropriate discharge rates and discharge temperatures can be extracted easily for a given riverflow and for specified temperature constraints imposed, e.g., in midstream. It was advocated that similar site-specific information and operations aides can be prepared for any outfall and are necessary to assess the all-time impact of an effluent on a water body. (Sims-ISWS)  
W78-07483

**SALT LOADING IN DISTURBED WATERSHED-FIELD STUDY.**  
Golder and Associates, Seattle, WA.  
J.W. Rowe, and D. B. McWhorter.  
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE2, Proceedings Paper 13688, p 323-338, April 1978. 7 fig, 8 tab, 24 ref.

Descriptors: \*Salts, \*Water quality, \*Colorado River, \*Colorado River Basin, Watershed management, Coals, Hydrology, Salinity, Oil shales, On-site investigations, Strip mines, Environment, \*Salt loading, Low sulfur coals, Environmental assessment.

Salt loading of waters receiving drainage from lands disrupted by mining was estimated from nearly 3 years of field data on a strip-mined watershed in Western Colorado. Observed salt loading was separated into approximate contribu-

tions from mined land, undisturbed land, groundwater runoff, and overland runoff. The inorganic composition of mine drainage was found to be very similar to that obtained in saturation and 1:1 extracts prepared from the disturbed material. Calcium, magnesium, and sulfate dominated the dissolved solids content of the water. In water years 1974 and 1975, the salt loading from mined land was estimated to be 2.37 tons/acre (5,330 kg/ha) and 2.13 tons/acre (4,790 kg/ha), respectively. It was estimated that 56% of the total observed salt loading was attributed to mined lands that comprised 17% of the contributing watershed area. (Roberts-ISWS)  
W78-07484

**FORCED PLUMES IN A STRATIFIED RESERVOIR.**  
Salford Univ. (England). Dept. of Civil Engineering.  
For primary bibliographic entry see Field 8B.  
W78-07489

**TWO-DIMENSIONAL PLUME IN UNIFORM GROUND-WATER FLOW.**  
Massachusetts Inst. of Tech. Cambridge. Dept. of Civil Engineering.  
J. L. Wilson, and P. J. Miller.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY4, Proceedings Paper 13665, p 503-514, April 1978. 6 fig, 17 ref, 3 append.

Descriptors: \*Groundwater, \*Dispersion, \*Water pollution, \*New York, Model studies, Mathematical models, Adsorption, Path of pollutants, Pollutants, Chromium, Wells, Water wells, Groundwater movement, Water quality, Plumes, Groundwater plumes.

A simple analytical model of a two-dimensional plume of groundwater pollution was developed and applied to the study of hexavalent chromium contamination of Long Island, New York. The model was based on a depth-averaged mass transport equation accounting for convection, dispersion, linear equilibrium adsorption, and decay, and was applicable to the study of pollution migration from point sources in shallow groundwater aquifers. The pollutant concentration description was based on an asymptotic solution to Hantush's well function for a leaky aquifer and was accurate in the far field downstream of the source. The model results were easily visualized and evaluated when plotted as contour lines of equal concentration using a simple graphical procedure, making it convenient to examine the development of the plume over time and to evaluate the sensitivity of the plume to parameters. (Sims-ISWS)  
W78-07490

**PREDICTION OF TEMPERATURE DUE TO HEATED DISCHARGES.**  
Cooper Union, (NY) NY. Dept. of Civil Engineering.  
J. C. Cataldo, R. R. Zavesky, and A. S. Goodman.  
Journal of the Power Division, American Society of Civil Engineers, Vol. 104, No. PO2, Proceedings Paper 13660, p 199-212, April 1978. 5 fig, 3 tab, 7 ref, 2 append.

Descriptors: \*Heated water, \*Lake Ontario, \*Thermal powerplants, \*Thermal pollution, \*Model studies, \*Michigan, Mathematical models, Temperature, Water temperature, Lakes, Cooling water, Powerplants, Effluents, Measurement, Forecasting, Plumes, Thermal plumes.

A phenomenological model was developed for the prediction of subsurface temperature from a given set of surface isotherms due to heated effluent discharge from a thermal-electric power plant. When surface isotherms are obtained from infrared overflight measurements, the model can provide estimates of subsurface isotherms. For

given categories of surface discharge and lake conditions, exponential equations relating areas and temperatures along the center line of the plume for surface isotherms to areas and center line temperatures for subsurface isotherms were used to predict subsurface temperatures within approx 0.25C (0.45F) of the measured temperatures, for depths up to 10 ft below the surface. The data used to calibrate and verify the model were a comprehensive set of triaxial hydrothermal surveys of Lake Michigan, conducted by Argonne National Laboratories. The model also was used to predict subsurface temperatures in Lake Ontario. (Sims-ISWS)  
W78-07495

**NONPOINT NITRATE CONTAMINATION OF GROUND WATER IN MERRICK COUNTY, NEBRASKA.**  
Nebraska Univ., Lincoln. Div. of Natural Resources, Conservation and Survey.  
R. F. Spalding, J. R. Gormly, B. H. Curtiss, and M. E. Exner.  
Ground Water, Vol. 16, No. 2, p 86-95, March-April 1978. 6 fig, 1 tab, 24 ref.

Descriptors: \*Groundwater, \*Nitrates, \*Water pollution sources, \*Nebraska, Water quality, Irrigation wells, Nitrogen, Soils, Leaching, Soil texture, Fertilizers, Drainage, Sampling, Nonpoint pollution sources, Gray-scale mapping.

The areal distribution of 293 samples from the groundwater of Merrick County, Nebraska, has definite patterns of high (greater than 20 ppm), intermediate (10-20 ppm), and low (less than 10 ppm) nitrate-nitrogen concentrations. Where contamination is present, the nitrate-nitrogen concentrations are relatively homogeneous, indicating large diffuse nonpoint sources. SYMAP (gray-scale mapping) indicates exceptionally good correlation between the irrigated coarse-textured soils and the higher nitrate-nitrogen levels. The obvious implication is that the nitrate-nitrogenous material dispersed in or on the coarser-textured soils. The widespread use of commercial nitrogen fertilizer on irrigated corn acreages is suspected of being the major contributor of nitrate to the groundwater. (Visocky-ISWS)  
W78-07506

**SUSPENDED-MATTER DISTRIBUTION IN THE NEW YORK BIGHT APEX RELATED TO HURRICANE BELLE.**  
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Atmospheric Labs.; and National Oceanic and Atmospheric Administration, Miami, FL. Marine Geology and Geophysics Lab.  
For primary bibliographic entry see Field 2L.  
W78-07509

**RATE OF AMMONIUM NITRIFICATION AND NITRATE LEACHING IN SOIL COLUMNS.**  
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.  
P. R. Corey, D. B. McWhorter, and J. L. Smith.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 928. Price codes: A05 in paper copy, A01 in microfiche. Report NSF/RA-760505, November 1976. 8 fig, 21 tab, 42 ref, 3 append.

Descriptors: \*Nitrates, \*Ammonia, \*Leaching, \*Clay loam, \*Nitrification, Nitrogen, Leachate, Velocity, Laboratory tests, Analytical techniques, Waste water treatment, Sludge disposal.

The rate of nitrification of ammonium, the leaching rate of nitrates through a saturated soil column, and the effect of aeration on nitrate leaching were observed in laboratory experiments to evaluate the impact of sewage sludge application to soils. Ammonium sulfate was applied to clay loam soil packed in 1.32 m columns; n<sup>2</sup>



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

concentrations in the leachate from each column were measured. The nitrate leaching rate through the soil columns was calculated by the addition of sodium nitrate to the inflow water. The time required for nitrates to leach through the soil was significantly longer than the rate at which nitrification occurred. Nitrate leaching to a depth of 100 cm required a period five times longer than the time required for nitrification. In the clay loam soil, the seepage velocity was four times greater than the nitrate ion travel velocity. Water velocity was described as a function of inflow, saturated hydraulic conductivity, porosity, and a pore size distribution parameter. Unrealistic estimations of the parameters were required to predict the nitrate ion velocity through the soil column as a function of the water velocity equation. (Lisk-FIRL) W78-07520

**SUB-SEABED DISPOSAL OF RADIOACTIVE WASTE: PREVENTION OR MANAGEMENT,** Woods Hole Oceanographic Institution, MA. Marine Policy and Ocean Management Program. For primary bibliographic entry see Field 5E. W78-07536

**ENVIRONMENTAL MANAGEMENT OF A SHIP CHANNEL-HARBOR COMPLEX,** Texas A and M Univ., College Station. Dept. of Civil Engineering. M. W. Reavis, and R. W. Hann, Jr. Sea Grant Report No. TAMU-SG-78-202, November 1977. 145 p, 21 fig, 32 tab, 73 ref. SG-04-6-158-44012.

Descriptors: \*Water pollution sources, \*Harbors, \*Waterways (Transportation), Waste disposal, Texas, Corpus Christi harbor (Tex), Brownsville harbor (Tex), Ship channels, Environmental management, Dredged spoil disposal.

This study discusses the environmental management of a typical ship channel-harbor complex located along the Texas Gulf Coast. The best current available literature was utilized along with a number of previous studies completed at Texas A and M University. This information was supplemented by a field study of the Port of Corpus Christi Inner Harbor and the Port of Brownsville Fishing Harbor, along with a non-point source pollution study of the Port of Brownsville watershed. The study explains the most important pollution sources, discusses their impact upon the waterways, outlines plan of action. The long-range environmental implications of the various activities are discussed so that management entities may make competent decisions in future planning that are conducive to an active industrial climate and a healthy environment. (NOAA) W78-07539

**CIRCULATION. MESA NEW YORK BIGHT ATLAS MONOGRAPH 3,** MESA New York Bight Project Office, Albany. For primary bibliographic entry see Field 2L. W78-07541

**WATER QUALITY. MESA NEW YORK BIGHT ATLAS MONOGRAPH 27,** MESA New York Bight Project, Office, Albany. D. J. O'Connor, R. V. Thomann, and H. J. Salas. New York Sea Grant Institute Report No. NYSSGP-AM-77-013, October 1977. 103 p, 19 fig, 8 tab, 45 ref, 23 maps.

Descriptors: \*Waste disposal, \*Water quality, New York, Monitoring, Heavy metals, Water pollution sources, Pollutant identification, \*Outer Continental Shelf, \*New York Bight, Ocean dumping, Barge discharges.

The water quality of New York Bight as measured by temperature, light, salinity, dissolved oxygen, various nitrogen and phosphorus forms, pH,

heavy metals, coliform bacteria, and phytoplankton chlorophyll is described. Bottom dissolved oxygen percent saturation levels in the disposal areas of the apex have decreased from 67% in 1949 to 30% in 1974. Surface total iron concentrations in the apex have increased and are higher than background open ocean levels. Coliform bacterial influence appears to be confined to an area of 3.2 to 4.8 km (2 to 3 mi) radius from the discharge point of a sewage sludge barge dump. Nitrogen is generally the more important nutrient relative to phosphorus with respect to limiting phytoplankton growth in the Bight. Man's impact on the water quality of the region appears to be significant with more than 50% of the total input of iron, copper, cadmium, chromium, suspended solids, and total phosphorus attributed to barge discharges alone. (NOAA) W78-07542

**NEARSHORE FISH AND MACROINVERTEBRATE ASSEMBLAGES ALONG THE STRAIT OF JUAN DE FUCA INCLUDING FOOD HABITS OF NEARSHORE FISH,** National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office. For primary bibliographic entry see Field 2L. W78-07543

**SURFACE DRIFTER MOVEMENTS OBSERVED IN OUTER STRAIT OF JUAN DE FUCA, JULY 1977,** National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office. C. C. Ebbsmeyer, J. M. Helseth, and J. M. Cox. NOAA Technical Memorandum ERL MESA-22, October 1977. 74 p, 7 fig, 3 tab, 4 plates, 3 ref.

Descriptors: \*Baseline studies, \*Oil spills, \*Tidal effects, Winds, Water pollution sources, \*Outer Continental Shelf, \*Surface currents, \*Wind effects, Strait of Juan de Fuca, Drifters, Petroleum development, Pollutant movement.

An oceanographic experiment was conducted in the Outer Strait of Juan de Fuca off Pillar Point during 19-23 July 1977. This exploratory experiment was designed for dual purposes: (1) to observe movements of surface drifters which approximate movements of potential oil slicks; and (2) to measure surface currents for comparison with observations from moored current meters and a moored anemometer both deployed by Pacific Marine Environmental Laboratory (PMEL). Seventy-seven thin, floatable drifters were launched at 1/4 - 1 mile intervals cross channel. The position, velocities, trajectories, and spatial vector diagrams are provided for six to eight hour intervals during which drifter positions were observed several times per hour. An apparent net cross channel drift toward U.S. was observed, with shore recoveries high in Clallam Bay and in the lee of Pillar Point, suggesting these as possible entrapment areas. The cross channel drift appears highest on flood tides concurrent with westerly winds. (NOAA) W78-07545

**INDUSTRIAL WASTES, MESA NEW YORK BIGHT ATLAS MONOGRAPH 30,** New York Sea Grant Inst., Albany. J. A. Mueller, and A. R. Anderson. New York Sea Grant Institute Report No. NYSSGP-AM-77-017, January 1978. 39 p, 17 fig, 11 tab, 7 maps.

Descriptors: \*Water pollution sources, \*Industrial wastes, New York, \*Waste disposal, \*Ocean dumping, \*New York Bight.

The New York City metropolitan area, at the apex of New York Bight, supports vast industrial activity. In the past two decades the relative importance

of manufacturing in the New York region has declined compared to the rest of the nation, but the area maintains its status as the largest center of manufacturing in the United States. Such industrial activity generates waste residuals that are discharged to the environment. To evaluate the significance of these industrial wastes, the location and mass loads of industrial inputs are compared to those from nonindustrial sources. In the Bight area, much wastewater is now discharged through primary, as well as secondary, treatment plants. New federal regulations prescribing treatment levels and phasing out some ocean dumping are expected to bring about some improved water quality. Industrial discharges contribute significant portions of the contaminant input loads to New York Bight. Future decisions on waste management must consider interrelationships among all contaminant sources. (NOAA) W78-07547

**THE 1973 BATHYMETRIC SURVEY IN THE NEW YORK BIGHT APEX: MAPS AND GEOLOGICAL IMPLICATIONS,** National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office. For primary bibliographic entry see Field 2L. W78-07548

**NUTRIENT DISTRIBUTIONS AND TRANSPORT IN LONG ISLAND SOUND,** State Univ. of New York at Stony Brook. Marine Sciences Research Center. M. J. Bowman. New York Sea Grant Institute Reprint Series No. NYSSGP RR-78-01, Reprinted from: Estuarine and Coastal Marine Science, Vol. 5, p 531-548, 1977. 16 fig, 4 tab, 32 ref. Also as: SUNY, Marine Sciences Research Center Contrib. No. 162. SG-2 35281.

Descriptors: \*Nutrients, \*Sewage effluents, \*Ammonia, \*Nitrates, Nitrogen, New York, Estuaries, Eutrophication, \*Path of pollutants, \*Long Island Sound, New York Bight, Seasonal variations, Nutrient transport.

Inorganic nitrogenous nutrient distributions and transport in Long Island Sound are investigated for both winter and summer conditions with a steady state, one dimensional mass balance model. Nutrient budgets based on horizontal exchange, lateral input from sewage and agricultural sources, and first order biochemical uptake are computed for each of 13 regions in the Sound. All nutrient concentrations, principally ammonia, peak sharply in the upper East River where a strong point source exists. Concentration distributions and uptake rates are consistent with previous studies of the nitrogen cycle and productivity of the Sound. However, this paper stresses horizontal exchange and sewage as important and hitherto neglected components of the nutrient budgets in various regions. Estimates of the loss of nitrogen to the sediment are presented for the western, central and eastern regions, from the Sound to the ocean at the eastern end, and into New York Harbor from the upper East River. Sewage effluents are shown to be the prime external source of nutrients for the Sound. (NOAA) W78-07550

**SURFACE CURRENTS AS DETERMINED BY DRIFT CARD RELEASES OVER THE CONTINENTAL SHELF OFF CENTRAL AND SOUTHERN CALIFORNIA,** National Marine Fisheries Services, Seattle, WA. J. L. Squire, Jr. NOAA Technical Report NMFS SSRF-718, December 1977. 15 p, 2 fig, 11 ref.

Descriptors: \*California, \*Surface waters, \*Continental Shelf, \*Ocean currents, Drifting (Aquatic), Eddies, Baseline studies, \*Outer

Continental Shelf

During March plastic drift cards from an aircraft over two areas off central California; Point Sur; and southern California. Punta Salispu recovery rate 5.7% in the so recoveries were data of relea concluded by tion of the di returned incre of an eddy or and Monterey of the large t nia countercur ing April thro October and W78-07556

**ENVIRONM ALASKAN N PRINCIPAL THE QUAR National On tion, Boulv environmental For primary W78-07558**

**ENVIRONM ALASKAN IL PRINC FOR THE National On tion, Boulv environmental For primary W78-07559**

**ENVIRONM ALASKAN PRINCIPAL THE QUAR National On tion, Boulv environmental For primary W78-07560**

**ENVIRONM ALASKAN II, PRIN FOR THE National On tion, Boulv environmental For primary W78-07561**

**ENVIRONM ALASKA III, PRIN FOR THE National On tion, Boulv environmental For primary W78-07562**

**NUTRIE TROL / CONTACT Robert J. Ads. OK J. F. Mc**



## Sources Of Pollution—Group 5B

Continental Shelf, \*Surface currents, Pollutant transport, Petroleum.

During March 1964 through February 1966, 8,320 plastic drift cards were released at selected points from an aircraft to measure surface current drift over two areas: from the coast to about 48 n.m. off central California between Point Arena and Point Sur; and from the coast to about 90 n.m. off southern California between Point Arguello and Punta Salspuedes, Baja California, Mexico. The recovery rate was 3.5% in the central area and 5.7% in the southern area. An average 79.4% of the recoveries were found within 2 wk following the data of release. Results lend support to studies concluded by earlier investigators. The distribution of the directions from which drift cards were returned increased the evidence for the presence of an eddy off the coast between San Francisco and Monterey Bay during May through July, and of the large gyre and associated southern California countercurrent south of Point Conception during April through August and to a lesser extent in October and December. (NOAA) W78-07556

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME I. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER APRIL - JUNE 1977.** National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program. For primary bibliographic entry see Field 6G. W78-07558

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME II. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER APRIL - JUNE 1977.** National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program. For primary bibliographic entry see Field 6G. W78-07559

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME I. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER JULY - SEPTEMBER 1977.** National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program. For primary bibliographic entry see Field 6G. W78-07560

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME II. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER JULY - SEPTEMBER 1977.** National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program. For primary bibliographic entry see Field 6G. W78-07561

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME III. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER JULY - SEPTEMBER 1977.** National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program. For primary bibliographic entry see Field 6G. W78-07562

**NUTRIENT, BACTERIAL, AND VIRUS CONTROL AS RELATED TO GROUND WATER CONTAMINATION.** Robert S. Kerr Environmental Research Lab., Ada, OK. J. F. McNabb, W. J. Dunlap, and J. W. Keeley.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 360. Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/8-77-010, July, 1977. 24 p. 2 fig. 1 tab, 9 ref, 2 append.

Descriptors: \*Groundwater, \*Bacteria, \*Viruses, \*Nutrients, Water pollution sources, Microorganisms, Filtration, Groundwater movement, Soil chemical properties, Soil physical properties, Phosphorus compounds, Nitrogen compounds.

The fate of pollutants in the subsurface environment cannot be assessed without a complete understanding of this environment's complexity as a pollution receptor; not only does the geologic matrix vary greatly in both the vertical and horizontal directions, but tremendous surface areas are also available for sorption of pollutants. Studies have shown that, in the U.S. at least, many of the major ground water contamination problems relate to the addition of nutrients, bacteria, and viruses. Phosphorus and nitrogen compounds are used to describe categorically the potential for nutrient contamination. Degree of phosphorus contamination is largely dependent upon overlying soil's capacity to sorb phosphorus, the kinetics of this reaction, and the solubility of naturally occurring phosphate minerals. The subsurface chemistry of nitrogen and its compounds is extremely complex, thus, most concern and research has been directed toward nitrate and nitrite ions. The pollution potential of bacteria and viruses is essentially equatable to their time of survival and the distances they might traverse during this time, which are, in turn, dependent upon 'environmental obstacles' (competing microorganisms, inadequate nutrient sources, etc.) and the absorptive capacity of adjacent soils or formations. (Report includes 48-reference bibliography). (Eberle-NWWA) W78-07571

**MICROBIAL INTERACTIONS WITH PESTICIDES IN ESTUARINE SURFACE SLICKS.** Georgia State Univ., Atlanta. Dept. of Biology. For primary bibliographic entry see Field 5C. W78-07605

**PROCEEDINGS OF NATIONAL CONFERENCE: IRRIGATION RETURN FLOW QUALITY MANAGEMENT.** Colorado State Univ., Fort Collins. For primary bibliographic entry see Field 5G. W78-07606

**SIMULATION OF NITROGEN MOVEMENT, TRANSFORMATIONS, AND PLANT UPTAKE IN THE ROOT ZONE.** Florida Univ., Gainesville. Dept. of Soil Science. J. M. Davidson, P. S. C. Rao, and H. M. Selim. In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 9-18, May 16-19, 1977. 7 fig, 1 tab, 28 ref.

Descriptors: \*Simulation analysis, Model studies, Nitrogen, Soil water, Soil water management, Irrigation, Nitrification, Denitrification, Mineralization.

Two simulation models, a detailed research-type and a conceptual management-type, for describing the fate of nitrogen in the plant root zone are discussed. Processes considered in both models were: one-dimensional transport of water and water-soluble N-species as a result of irrigation/rainfall events, microbiological N-transformations, and uptake of water and nitrogen species by a growing crop. The research-type model involves a finite-difference approximations (explicit-implicit) of the partial differential equations describing one-dimensional water flow and convective-dispersive  $\text{NH}_4$  and  $\text{NO}_3$  transport, along with simultaneous plant uptake and

microbiological N-transformations. Ion-exchange (adsorption-desorption) of  $\text{NH}_4$  was also considered. The microbiological transformations incorporated into the model describe nitrification, denitrification, mineralization and immobilization. All transformation processes were assumed to be first order kinetic processes. The numerical solution was flexible in its soil surface boundary conditions, as well as initial conditions for soil water content and nitrogen concentration distributions in the soil profile. The solution can also be used for nonhomogeneous or multilayered soil systems. The research-type model involves a detailed description of the individual process and requires a large number of input parameters, most of which are frequently unavailable. Because of this a more simple management-type model was developed. Several simplifying assumptions were introduced into the management model. This model requires a minimal amount of input data by the user, and provides a gross description of the behavior of various nitrogen species in the plant root zone. (See also W78-07606) (Skogerboe-Colorado State) W78-07608

**NITRATE MOVEMENT IN CLAY SOILS AND METHODS OF POLLUTION CONTROL.** Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences; and Texas Agricultural Experiment Station, College Station. A. R. Swoboda.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 19-25, May 16-19, 1977. 2 fig, 5 tab, 6 ref.

Descriptors: \*Path of pollutants, \*Nitrates, \*Clays, Soils, Soil investigation, Pollution, \*Water pollution control, Leaching, Lysimeters, Fertilizers, Runoff, Model studies, Nitrification, Crop response.

Movement of nitrates were measured in soils to determine quantitative amounts of losses. Leaching losses in lysimeters ranged from 0.04 to 6 percent depending on nitrogen source and climatic conditions. Nitrate concentrations in shallow wells within watersheds indicated that nitrates from applied fertilizer was leaching into the shallow groundwaters. Concentrations as high as 60 ppm  $\text{NO}_3\text{-N}$  were found in some wells after the initial rains following fertilization. Runoff from the watershed contained very little nitrate and amounted to less than 4 percent of the fertilizer applied. A descriptive model of nitrate movement in clay soils is presented. Methods of reducing nitrate leaching in soils are discussed. Field studies indicated that inhibiting nitrification was an effective means of reducing nitrate movement from ammonium fertilizers. Slow release sulfur coated urea also reduced nitrate movement when applied in the fall or winter. Delaying fertilization until planting was also an effective means of reducing nitrate losses without reducing yields. (See also W78-07606) (Skogerboe-Colorado State) W78-07609

**EFFECT OF THREE IRRIGATION SYSTEMS ON DISTRIBUTION OF FERTILIZER NITRATE NITROGEN IN SOIL.** Texas Agricultural Experiment Station, Lubbock. A. Onken, C. W. Wendt, O. C. Wilke, R. S. Hargrove, and W. Bausch. In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 27-32, May 16-19, 1977. 9 tab, 2 ref.

Descriptors: Irrigation, \*Irrigation systems, \*Fertilizers, Nitrates, Soils, Fertilization, Corn, Sprinkler irrigation, Furrow irrigation, Subsurface irrigation, \*Distribution, \*Path of pollutants.

Sweet corn was grown two years on a Miles loamy fine sand fertilized with band applied 15N enriched sodium nitrate. Two plots, 6 x 6 m, were

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

established under each of the three irrigation systems—sprinkler, furrow and subirrigation. A starter band of fertilizer was applied 7.6 x 7.6 cm from the seed with the rest sidedressed 25 cm either side of the center of the seedbed. Total nitrogen applied was 124 kg/ha in 1973 and 105 kg/ha in 1974. In 1974, each of the six plots that were established in 1973 were divided in half, one half receiving 15N enriched fertilizer as sodium nitrate, and the other half receiving the same amount of unenriched sodium nitrate. Soil samples were taken periodically from furrow to furrow in lateral distance increments of 25 cm and through the starter fertilizer band to a depth of 5.2 m in 30 cm increments. Plant samples were obtained at the end of each growing season. Soil and plant samples were analyzed using standard procedures. Fertilizer nitrogen moved differently under the three irrigation systems. When sprinkler-irrigated, fertilizer bands tended to maintain their integrity during downward movement. Under furrow irrigation, fertilizer bands tended to merge in the center of the bed and move downward. Under subirrigation, fertilizer tended to move down under the furrows. At the end of two crop years, greatest depth movement of fertilizer nitrogen was under sprinkler irrigation and least under subirrigation. (See also W78-07606) (Skogerboe-Colorado State) W78-07610

#### VARIABILITY OF NITRATE LEACHING WITHIN DEFINED MANAGEMENT UNITS, California Univ., Riverside.

L. J. Lund, and P. F. Pratt.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 45-53, May 16-19 1977. 6 fig, 6 tab, 20 ref.

Descriptors: Soils, Soil investigations, Fertilizers, Fertilization, Return flow, \*Nitrates, \*Leaching, Sampling, \*California, \*Variability.

In attempting to relate nitrate concentrations below root zones to root zone soil characteristics, the experimental approach has consisted of a comparison of a number of sites within a defined management unit or field. The basic assumption in this approach has been that the management of the field is uniform and variations in nitrate leaching result from variations in soil characteristics. However, results reported herein show that even within a field of limited size, other sources and sinks can be significantly different at various sampling locations. The variation in these factors for a number of fields in the Santa Maria Valley, California is discussed. (See also W78-07606) (Skogerboe-Colorado State) W78-07612

#### SOIL NITRATE CONCENTRATIONS IN CORN PLOTS TREATED WITH ISOTOPICALLY LABELED NITROGEN FERTILIZER, California Univ., Davis. Dept. of Land, Air and Water Resources.

F. E. Broadbent, and A. B. Carlton.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 63-69, May 16-19, 1977. 8 fig, 4 tab, 6 ref.

Descriptors: \*Nitrates, Nitrogen, Soils, \*Fertilizers, Sampling, Soil physical properties, \*Corn(Field), Monitoring.

Soil solution composition has been monitored for 3 years at depths ranging from 30 to 300 cm at an experimental site on Yolo fine sandy loam where 15N-depleted ammonium sulfate has been applied at 0, 90, 180, and 360 kg N per year. Samples have been taken at approximately 2-week intervals during the growing season and less frequently during the winter and early spring. In unfertilized plots receiving 60 cm/yr irrigation water N03-N concentrations fluctuated widely near the surface, ranging from 3-4 up to about 35 ppm over a 2-1/2 year

period. At lower depths fluctuations were not as great, but at 300 cm N03-N consistently remained above 10 ppm. At 90 and 180 kg-fertilizer N, the latter level being sufficient to produce the maximum grain yield, very little N03-N derived from fertilizer was found below 120 cm. However, at the 360 kg level, fertilizer-derived nitrate was found to constitute a significant fraction of the total at all depths down to 300 cm. (See also W78-07606) (Skogerboe-Colorado State) W78-07614

#### THEORETICAL AND EXPERIMENTAL OBSERVATIONS OF WATER AND NITRATE MOVEMENT BELOW A CROP ROOT ZONE, California Univ., Davis. Dept. of Land, Air and Water Resources.

J. W. Biggar, K. K. Tanji, C. S. Simmons, S. K. Gupta, and J. L. MacIntyre.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 71-77, May 16-19, 1977. 9 fig, 1 tab, 4 ref.

Descriptors: Soils, Soil investigations, \*Soil water movement, Soil water, Crop production, Leaching, Nitrogen, Irrigation, \*Nitrates, \*Root zone.

A report of the progress of an experiment which attempts to deal with the spatial variability of a field soil is presented. The experimental objective is to measure the flux of water and nitrate leaching below the root zone of a crop by examining the behavior of nitrogen applied to a corn crop grown under irrigation. (See also W78-07606) (Skogerboe-Colorado State) W78-07615

#### MODELING SALINITY OF IRRIGATION RETURN FLOW WHERE SOURCES AND SINKS ARE PRESENT, Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.

R. J. Hanks, L. S. Willardson, and D. Melamed.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 99-107, May 16-19, 1977. 10 fig, 2 tab, 9 ref.

Descriptors: \*Model studies, Simulation analysis, \*Path of pollutants, \*Salinity, \*Return flow.

Managing irrigation return flow when salinity sources and sinks are present presents many complex difficulties. Models developed to include the source sink term in an empirical way show that wide variations in irrigation quality and quantity will have little influence on return flow for many years where the source-sink term is important. The quantity of salt in return flow is primarily determined by water flow because the soil solution concentration changes very slowly. Where a water table is present, successful irrigation might be practiced with no return flow for some conditions. Even where no source-sink term is considered, model predictions indicate irrigation management with no return flow for several years is possible with little reduction in yield. The influence of irrigation system uniformity is shown to be significant over several years time. Thus, it is evident that many possibilities for return flow management exist but the long term effects should not be overlooked. (See also W78-07606) (Skogerboe-Colorado State) W78-07617

#### QUALITY OF IRRIGATION RETURN FLOW FROM FLOODED RICE PADDIES, California Univ., Davis. Dept. of Soil and Crop Sciences.

K. W. Brown, L. E. Deuel, F. C. Turner, and J. D. Price.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado

State University, Fort Collins, Colorado p 153-166, May 16-19, 1977. 16 fig, 18 tab.

Descriptors: Irrigation, \*Return flow, \*Rice, Pesticides, Nutrients, Nitrates, Phosphates, Potassium, Fertilizers, \*Irrigation water, \*Water quality.

A three year field and laboratory study was conducted to determine the quantity and quality of irrigation return flow from flooded rice culture. Both intermittent and continuous flow irrigation techniques were evaluated. Selected pesticides and nutrients were applied at recommended and excessive rates. The concentrations of nitrate, phosphate and potassium in the return flow were all within levels of acceptable for drinking water. Only small amounts of the fertilizer applied to the soil before flood or in the floodwater were lost in the irrigation return flow. The large amounts of rainfall received each year diluted the salts in the flood water so that the salt load of the irrigation return flow did not differ greatly from that of the irrigation water. Increases in the electrical conductivity of the floodwater resulted from the release of certain ions from the soil after fertilizer applications. These increases lasted for periods of 5-10 days. (See also W78-07606) (Skogerboe-Colorado State) W78-07623

#### EVALUATION OF SURFACE IRRIGATION RETURN FLOWS IN THE CENTRAL VALLEY OF CALIFORNIA, California Univ., Davis. Dept. of Land, Air and Water Resources.

K. K. Tanji, J. W. Biggar, R. J. Miller, W. O. Pruitt, and G. L. Horner.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 167-173, May 16-19 1977. 9 fig, 2 tab, 7 ref.

Descriptors: \*Variability, \*Return flow, Water quality, Water quality control, \*California, \*Central Valley(Calif), Irrigation water, \*Dissolved solids, \*Suspended solids.

The variability in the quantity of surface return flows from two typical irrigation districts is reported for the 1975 and 1976 irrigation seasons. Factors contributing to such variations are noted. Emphasis is placed upon the concentration and mass emission of total dissolved solids and suspended solids. The implications of these findings are discussed relative to PI 92-500 and best management practices. (See also W78-07606) (Skogerboe-Colorado State) W78-07624

#### COMBINING AGRICULTURAL IMPROVEMENTS AND DESALTING OF RETURN FLOWS TO OPTIMIZE LOCAL SALINITY CONTROL POLICIES, Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.

For primary bibliographic entry see Field 5G. W78-07628

#### PRACTICAL APPLICATIONS OF IRRIGATION RETURN FLOW QUALITY MODELS TO LARGE ACREAGES, Bureau of Reclamation, Denver, CO. Engineering and Research Center.

For primary bibliographic entry see Field 5G. W78-07629

#### HYDRO-SALINITY MODELS: SENSITIVITY TO INPUT VARIABLES, Agricultural Research Service, Riverside. Salinity Lab.

J. D. Oster, and J. D. Wood.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado

State Univ., Fort Collins, Colorado p 153-166, May 16-19, 1977. 16 fig, 18 tab.

Descriptors: Irrigation, \*Return flow, \*Rice, Pesticides, Nutrients, Nitrates, Phosphates, Potassium, Fertilizers, \*Irrigation water, \*Water quality.

Return flow budget analysis increasing the sensitivity of flows may obtain an order of degree of greater in greater soil shorter growth (Skogerboe-Colorado State) W78-07632

#### MODELING FLOW SINKS AND FUTURE AGRICULTURE, Colorado State Univ., Fort Collins. Dept. of Land, Air and Water Resources.

J. E. Ayar, and J. E. Ayar.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 173-179, May 16-19 1977. 10 fig, 2 tab, 9 ref.

#### MODELING IRRIGATION RETURN FLOWS IN THE CENTRAL VALLEY OF CALIFORNIA, California Univ., Davis. Dept. of Land, Air and Water Resources.

K. K. Tanji, J. W. Biggar, R. J. Miller, W. O. Pruitt, and G. L. Horner.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 167-173, May 16-19 1977. 9 fig, 2 tab, 7 ref.

Descriptors: \*Variability, \*Return flow, Water quality, Water quality control, \*California, \*Central Valley(Calif), Irrigation water, \*Dissolved solids, \*Suspended solids.

This study of the variability of the quantity of surface return flows from two typical irrigation districts is reported for the 1975 and 1976 irrigation seasons. Factors contributing to such variations are noted. Emphasis is placed upon the concentration and mass emission of total dissolved solids and suspended solids. The implications of these findings are discussed relative to PI 92-500 and best management practices. (See also W78-07606) (Skogerboe-Colorado State) W78-07624

#### MODELING IRRIGATION RETURN FLOWS IN THE CENTRAL VALLEY OF CALIFORNIA, California Univ., Davis. Dept. of Land, Air and Water Resources.

K. K. Tanji, J. W. Biggar, R. J. Miller, W. O. Pruitt, and G. L. Horner.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 167-173, May 16-19 1977. 9 fig, 2 tab, 7 ref.

#### MODELING IRRIGATION RETURN FLOWS IN THE CENTRAL VALLEY OF CALIFORNIA, California Univ., Davis. Dept. of Land, Air and Water Resources.

K. K. Tanji, J. W. Biggar, R. J. Miller, W. O. Pruitt, and G. L. Horner.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 167-173, May 16-19 1977. 9 fig, 2 tab, 7 ref.

## Effects Of Pollution—Group 5C

State University, Fort Collins, Colorado, p 253-259, May 16-19, 1977. 7 fig, 2 tab, 6 ref.

Descriptors: \*Model studies, \*Simulation analysis, Water quality, \*Return flow, \*Salinity, Irrigation efficiency.

Return flows estimated from salinity, or a water budget analysis, exhibit opposite sensitivities to increasing field irrigation efficiencies. However, the sensitivities of both methods to assess return flows may be complementary if both are used to obtain an optimized estimate of return flows. The degree of data uncertainty would undoubtedly be greater in areas with multiple return flow paths, greater sources of underflows and rainfall, and shorter growing seasons. (See also W78-07606) (Skogerboe-Colorado State) W78-07632

#### MODELING THE IRRIGATION RETURN FLOW SYSTEM—CURRENT CAPABILITIES AND FUTURE NEEDS,

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering. For primary bibliographic entry see Field 5G. W78-07633

#### MODELING SALT TRANSPORT IN THE IRRIGATED SOILS OF GRAND VALLEY,

Maryland Univ., College Park. Dept. of Agriculture Engineering. J. E. Ayars, D. B. McWhorter, and G. V. Skogerboe. In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 369-374, May 16-19 1977. 6 fig, 1 tab, 6 ref.

Descriptors: \*Model studies, \*Simulation analysis, Colorado, Colorado River Basin, Salinity, \*Saline soils, Saline water, Leachate, \*Return flow, \*Grand Valley(Colo).

This study was undertaken to evaluate the effects of the volume of leachate leaving the soil profile on the quality of the leachate. A numerical salt transport model was selected for use in the study. Field data to calibrate the model were collected on 63 research plots located in the Grand Valley. The model was tested and calibrated with the field data and then used in a series of hypothetical simulations designed to provide the required information. The modeling results indicate that the salt concentration of the leachate is independent of the volume of leachate. The six-year simulation showed that the concentration of salt below the root zone was relatively constant. Therefore, the salt loading due to subsurface irrigation return flows can be calculated from a water budget analysis, with salt load reductions being directly proportional to the reduced volume of subsurface return flow. (See also W78-07606) (Skogerboe-Colorado State) W78-07648

#### MODEL STUDY OF COOL WATER DISCHARGE FROM PROPOSED LNG FACILITY, LOS ANGELES HARBOR, CALIFORNIA,

Army Engineer Waterways Experiment Station, Vicksburg, MS. W. H. McAnally, Jr. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A050 023, Price codes: A09 in paper copy, A01 in microfiche. Miscellaneous Paper H-77-13, November 1977. 183 p, 8 fig, 6 tab, 4 ref, 155 pl.

Descriptors: \*Thermal pollution, \*Heated water, Cooling water, \*Hydraulic models, \*Dyes, \*Discharge(Water), Model studies, Docks, Tracers, \*Los Angeles Harbor(Calif), \*Dilution, California.

Physical hydraulic model dye tests were conducted to define near-field dilution of a cool-water discharge from a proposed LNG facility in Los Angeles Harbor, California, and to describe the far-field behavior of the resulting plume. (WES) W78-07669

#### DISPERSION OF PROPOSED EFFLUENT DISCHARGES AND SALTWATER INTRUSION IN COOPER RIVER; HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, MS. H. A. Benson, and R. A. Boland. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A051 928, Price codes: A09 in paper copy, A01 in microfiche. Miscellaneous Paper H-77-14, November 1977. 177 p, 15 tab, 122 pl.

Descriptors: \*Hydraulic models, \*Salinity, \*Effluents, \*Dispersion, \*Dye dispersion, \*Saline water intrusion, South Carolina, \*Cooper River(SC), Charleston Harbor(SC).

An existing comprehensive physical model that correctly reproduced tides, tidal currents, and density currents throughout the Charleston Harbor was used to determine what quantity, if any, of effluents discharged into Cooper River would be transported from three proposed discharge points (located between miles 30 and 37 on Cooper River) to the mouth of the freshwater intake canal for the reservoir (located at mile 43) and subsequently through the intake canal into the reservoir proper. In addition to travel times of the effluents to critical locations, it was desired to determine the maximum concentrations of the effluents in Cooper River and Back River Reservoir. It was desired to know the rates of increases of effluent concentrations at critical locations should the freshwater discharge from Pinopolis reduce to zero. It was also desired to know if there would be saltwater intrusion into Back River Reservoir during operation of the Schedule C and Schedule E hydrographs. (WES) W78-07670

#### GROUNDWATER TRACING WITH POST SAMPLING ACTIVATION ANALYSIS USING BROMIDE AND IODIDE IONS INJECTED SIMULTANEOUSLY INTO A SHALLOW-WELL SYSTEM,

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. W. L. Osmin. Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 113, Price codes: A07 in paper copy, A01 in microfiche. Master of Science thesis in Nuclear Engineering, The Pennsylvania State University, University Park, Dept. of Nuclear Engineering, August 1977. 132 p, 14 tab, 17 fig, 58 ref, 4 append. OWRT A-046-PA(1), 14-34-0001-6039.

Descriptors: \*Groundwater, \*Bromides, \*Iodides, \*Tracers, \*Hydraulic conductivity, \*Injection wells, Velocity, \*Groundwater velocity, Flow pattern, Direction of flow.

Groundwater study results indicate that bromide and iodide are suitable tracers for determining average velocity and hydraulic conductivity values and the direction of flow. Facts from the experimental data suggest, however, that the response of the shallow groundwater system is markedly different from what it was previously thought to be. Summary results are: (1) the tracer concentrations remaining in the injection well 35 weeks after tracer injection are an order of magnitude greater than the corresponding background levels; (2) the high tracer concentration remaining in the injection well at the end of the sampling period indicates that the well is acting as a tracer storage reservoir, continually injecting bromide and iodide into the groundwater system; (3) local values of

.333 ft/day for the average groundwater velocity and 4.9 ft/day for the hydraulic conductivity were determined for the area between the injection and observation wells located two feet downgradient; (4) the tracers respond similarly over short distances, but differ as they travel farther; (5) the tracer 'breakthrough' curves indicate that the tracer peaks were missed by starting sample collection too late; (6) the existence of 'preferred' paths of flow indicate that nonuniform flow conditions prevail; (7) analysis of the 'breakthrough' curves for two wells indicated that the sampling schedule had missed the peak arrivals; and (8) the predicted response of the shallow system was based on pumping tests which established the average hydraulic conductivity as .4 ft/day (Sink-Penn State) W78-07683

#### URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN FRANCE,

Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathématique.

For primary bibliographic entry see Field 2A.

W78-07694

#### URBAN HYDROLOGY STUDIES AND MATHEMATICAL MODELING IN THE FEDERAL REPUBLIC OF GERMANY,

Landesanstalt fuer Wasser und Abfall Nordrhein-Westfalen, Dusseldorf (West Germany).

For primary bibliographic entry see Field 2A.

W78-07696

### 5C. Effects Of Pollution

#### WATER-COLUMN AND BENTHIC INVERTEBRATE AND PLANT ASSOCIATIONS AS AFFECTED BY THE PHYSICO-CHEMICAL ASPECTS IN A MESOTROPHIC BAYOU ESTUARY PENSACOLA, FLORIDA,

University of West Florida, Pensacola. Water Resources Research Center.

G. A. Moshiri, W. G. Crumpton, W. G. Aumen, C. T. Gaetz, and J. E. Allen.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 571, Price codes: A08 in paper copy, A01 in microfiche. Florida Water Resources Research Center, Gainesville, Publication No. 41, March 1978. 160 p, 16 fig, 1 tab, 22 ref. OWRT B-033-FLA(1), 14-34-0001-7149.

Descriptors: Invertebrate fauna, Heterotrophic uptake, Benthic organisms, Water column life, Primary productivity, \*Mesotrophy, \*Florida, \*Bayou Texar(Fla), \*Estuaries, Cryptophytes, Dissolved oxygen, Ammonia, Salinity, Nitrates, Organic carbon, Brachionus plicatilis, Oithona colcarva, Zooplankton, Phytoplankton, Phosphates.

Water column samples were collected every two weeks over a one-year period from three stations in mesotrophic Bayou Texar, Pensacola, Florida. The samples were analyzed for -NO<sub>3</sub>, -NH<sub>3</sub>, -PO<sub>4</sub>, and total organic carbon against a background of physical parameters. Phytoplankton and zooplankton populations present during the study period were identified and enumerated. Benthic core samples were collected to assess the macroinvertebrate populations; however, analysis indicated a paucity of organisms in general. Data were subjected to appropriate statistical analysis to indicate possible relationships among aspects studied. Negative correlations appeared between salinity and nitrates, between ammonia and dissolved oxygen (at some stations), between Brachionus plicatilis and dissolved oxygen, and between Cryptophytes and dissolved oxygen. Positive correlations were indicated between total organic carbon and ammonia, between Brachionus and Cryptophytes, and between Brachionus and Oithona colcarva. (Morgan-Fla) W78-07203



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

#### THE RELATIONSHIP OF LAKE QUALITY TO SPECIFIC URBANIZATION STRESSES, Massachusetts Univ., Waltham. Dept. Environmental Sciences.

H. B. Gunner, and J. Rho.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 579. Price codes: A03 in paper copy, A01 in microfiche. Massachusetts Water Resources Research Institute, Amherst, WRRRC Publication No. 88, June 1977, 44 p, 10 tab, 16 fig, 11 ref. OWRT B-047-MASS(1), 14-31-0001-5083.

Descriptors: \*Lakes, \*Heavy metals, \*Water quality, \*Nitrates, \*Chlorinated hydrocarbon pesticides, Surface runoff, Nutrients, Urban sociology, \*Urbanization, Massachusetts, Pottapug Pond(Mass), Lake Lashaway(Mass), Water pollution sources, Water pollution effects.

Two comparable impoundments were selected for study. Pottapug Pond provided baseline data uncomplicated by human activity. Lake Lashaway has a long history of human activity and receives heavy nutrient loads and urban runoff. A comparison was made of the seasonal patterns of water quality and sedimentary records of the two bodies of water. Nitrate concentrations were significantly higher in Lake Lashaway in winter. This seasonal pattern results from a high rate of input from surface runoff and/or leaching. These appreciable amounts of nitrate supported the growth of aquatic weeds, indigenous bacteria and algae. Annual control of aquatic weeds by herbicide treatment in Lake Lashaway had adverse effects on water quality by increasing nutrient levels, reducing oxygen concentration in the littoral zone and subsequently killing fish. Littoral macrophytes appear to temporarily store phosphorus and nitrogen during the growing season but release them at later times. The accumulation of heavy metals and chlorinated hydrocarbon pesticides represents a potential source of pollutants. Concentrations of heavy metals, particularly Zn, in sediment cores, from Lake Lashaway but not Pottapug, provide an indication of related human/urban activity. Increased nitrogen concentrations, raised phosphorus levels, and the presence of heavy metals and pesticides in sediment cores all offer indices of the impact of urbanization on impoundments. (Idoine-Mass)

W78-07204

#### A TEST OF THE EFFECTS OF DOMESTIC SEWAGE ON THE GROWTH OF THE COMMON BLUE MUSSEL, MYTILUS EDULIS, IN AN AQUACULTURAL SYSTEM, Massachusetts Univ., Waltham. Dept. of Environmental Sciences.

J. Pardo, and R. A. Coler.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 580. Price codes: A04 in paper copy, A01 in microfiche. Massachusetts Water Resources Research Center, Amherst, WRRRC Publication No. 87, April 1977, 44 p, 8 tab, 11 fig, 18 ref. OWRT A-097-MASS(1), 14-34-0001-7046.

Descriptors: Aquaculture, Shellfish farming, \*Mussels, \*Domestic wastes, Biochemical oxygen demand, \*Sewage sludge, \*Growth rates, Water pollution effects, Organic carbon, Filter feeding.

The potential for increasing the growth rate of a filter-feeding marine bivalve mollusc, *Mytilus edulis*, by providing a mixture of domestic sewage and seawater in a controlled raceway system, has been assessed by comparing growth of test specimens with growth of controls in ambient estuarine water. To determine the effects of sewage on the filter-feeding activity, the profile of total organic carbon within the raceway system was measured. Factors involved in alternate feeding pathways, such as phytoplankton densities, dissolved nutrients, and biodeposits, in addition to several physical and biological parameters in the system

were monitored. The preliminary conclusion is that it is not feasible to use populations of *Mytilus* to reduce the biochemical oxygen demand exerted by sewage sludge on receiving waters. (Idoine-Mass)

W78-07205

#### AN ANALYTICAL EVALUATION OF THE UTILIZATION AND MANAGEMENT OF WATER RESOURCES IN THE LAKE METIGOSHE WATERSHED, NORTH DAKOTA, North Dakota State Univ., Fargo. Dept. of Zoology.

J. J. Peterka.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 568. Price codes: A02 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, Fargo, Partial Completion Report, Part II, WI-221-044-77, Oct. 1977, 13 p, 14 ref. OWRT A-034-NDAK(2), 14-31-0001-5034.

Descriptors: \*Eutrophication, Aquatic plants, Nutrients, Bioassay, Groundwater, Winterkilling, Hydrologic budget, Limnology, Water chemistry, Watershed management, Lake watersheds, \*Biota, Base flow, Rainfall, \*Hydrophytes, Nitrates, Phosphates, Algae, Diatoms, Flagellates, \*North Dakota, \*Lake Metigoshe Watershed(N Dak), Turtle Mountains(N DAK).

Lake Metigoshe, a shallow (maximum depth of 7.6m and a mean depth of 2.8m), 663 ha senescent lake in the Turtle Mountains of North Dakota, was studied from 1972 to 1975 to assess effects of intense recreational use on the lake biota. Hydrophytes occupied 86% of the surface area; their mean summer maximum biomass was 419g/m<sup>2</sup> dry weight in 1973, 615 in 1974 and 317 in 1975. No algae blooms occurred during 1972-1976. Inorganic N and P budgets were calculated from April to November, 1974. Rainfall contributed 46%, groundwater inflow 39%, and the inlet 15% of the total inorganic N input. Rainfall contributed 58%, the inlet 34%, and groundwater inflow about 8% of the total inorganic P input. Total input for the whole lake was 2500kg N and 300kg P. Retention of inorganic N and P inflow by the lake was 95% and 79%, respectively. A positive correlation ( $r = 0.88$ ) between rainfall and ground-water inflow was found. Groundwater flow rates were low, averaging 18 ml m<sup>2</sup>/h. From experiments to assess the response of phytoplankton and zooplankton to hydrophyte removal and to the addition of NO<sub>3</sub> alone and with PO<sub>4</sub> it was judged that small scale hydrophyte removal would probably cause increases in green flagellates, yellow-green algae, and diatoms.

W78-07209

#### THE EFFECT OF THE IONIC COMPOSITION OF THE ENVIRONMENT ON OXYGEN EXCHANGE IN THE ALGA ACETABULARIA (IN RUSSIAN), Dnepropetrovskii Khimiko-Tekhnologicheskii Inst. (USSR).

R. D. Apostolova, and O. S. Ksenzhek.

Fiziol Rast (Mosc) 24(1), p 51-56, 1977.

Descriptors: Marine algae, \*Acetabularia crenulata, \*Ions, Oxygen exchange, Sodium, Chlorides, Magnesium, Potassium, \*Photosynthesis.

The effect of ions of K, Na, Cl and Mg in the environment on the rate of O<sub>2</sub> evolution was studied with the marine alga *Acetabularia* (A. crenulata). The absence of Na<sup>+</sup> and Mg<sup>2+</sup> from the medium surrounding the cell decreases the productivity of photosynthesis which correlates with changes in the content of Na within the cell in the medium containing no Na. Cl and K deficiency in the environment has only a small effect on the rate of O<sub>2</sub> evolution.—Copyright 1978, Biological Abstracts, Inc.

W78-07213

#### STUDIES ON THE TOXICITY OF AMMONIA, NITRATE AND THEIR MIXTURES TO GUPPY FRY, Ohio State Univ., Columbus. Dept. of Civil Engineering.

A. J. Rubin, and G. A. Elmaraghy.

Water Research, Vol. 11, No. 10, p 927-935, 1977, 8 fig, 6 tab, 19 ref. OWRT A-033-OHIO(2).

Descriptors: \*Bioassay, \*Toxicity, \*Ammonia, \*Nitrates, \*Fish, Environmental effects, Waste water disposal, Lethal limit, Water pollution effects, Fish toxins.

The toxicities of ammonia and nitrate, administered separately and in mixtures, on guppy fry were evaluated. Individual toxicities of ammonia and nitrate, two common constituents of treated waste water, were estimated in static tests at constant pH and temperature. The 72-hour median lethal values were 199 and 1.26 mg/liter-N for potassium nitrate and free ammonia, respectively. The toxicities of mixtures of the two were additive, except at very low ammonia to nitrate ratios. Watson's equation, a disinfection law relating toxicant concentration to survival, was applicable to both toxicants. The applicability of Chick's law and other kinetic models to fish toxicity was also evaluated. (Baker-FIRL)

W78-07214

#### HYDRAULIC MODELING OF MIXING IN STRATIFIED LAKES, Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.

For primary bibliographic entry see Field 5B.

W78-07218

#### THE IMPACT OF THE 1975 BONNET CARRE SPILLWAY OPENING ON EPIFAUNAL INVERTEBRATES IN SOUTHERN LAKE PONTCHARTRAIN, New Orleans Univ., LA. Dept. of Biological Sciences.

M. A. Poirrier, and M. M. Mulino.

The Journal of the Elisha Mitchell Scientific Society, Vol. 93, No. 1, Spring 1977, p 11-18, 3 fig, 1 tab, 19 ref. OWRT A-038-LA(4).

Descriptors: \*Environmental effects, \*Salinity, Estuaries, Water quality, Lakes, \*Louisiana, Invertebrates, Populations, Aquatic life, Freshwater, Brackish water, Biological communities, \*Lake Pontchartrain(La).

Lake Pontchartrain in undergoing environmental change due to the construction of a navigation canal, which has changed its salinity regime, and the expansion of the New Orleans Metrolplex, which was reduced water quality. In this investigation, two estuarine epifaunal invertebrate populations were monitored during the introduction of Mississippi River water as the Bonnet Carre Spillway was opened in 1975. Because many of the species which normally occur in the estuary had been eliminated due to low salinity resulting from abundant rainfall during the year prior to the opening, little significant change in species composition and abundance was observed at the time of the spillway opening. It was concluded that, while some species were eliminated from the epifauna with changing salinity, a community of brackish-water species remains. (Chilton-ORNL)

W78-07219

#### PRELIMINARY TESTS OF THE INFLUENCE OF WASTE WATERS FROM SUGAR FACTORIES ON THE NUMBERS OF INTESTINAL BACTERIA IN WATER (IN GERMAN), Hygiene Stanice hl. m., Prague (Czechoslovakia). R. Adamek, I. Daubner, V. Johnova, and B. Trzilova.

Zentralbl Bakteriol Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Betriebshyg Praev Med 164(4), p 340-351, 1977.

Descriptors: effects, Ciliobacter-f, terobacter-a, sonnei, Stre

Experiment waters from on some (Escherich terobacter schottmuell and Streptococci were and 10 de wastewater C. freundii muelleri and S. faec directly p wastewater: 1:1000 (dil Copyright W78-07223

EFFECTS TERREST HABITAT WISCONS Stevens P For prima W78-0722

DETOXIC ENTERO Wehrwiss ABC-Sch For prima W78-0723

STABLE SOLVED SCHOEF (IN GER Bayerisch Munich F For prim W78-072

VIRUSE GENCY PROAC For prim W78-072

NITROG Danish Research V. Lars Progress 419-430.

Descript "Denmar tion, An ygen, stratific reduction

Nitrogen tion, wa lakes, r low lak Hald, eutroph Viborg from o increase ture rea a maxim June-Ju



Descriptors: \*Industrial wastes, Water pollution effects, \*Bacteria, Pollutant identification, Citobacter-freundii, \*Czechoslovakia, Enterobacter-aerogenes, Coli, Salmonella, Shigella-sonnei, Streptococcus-faecalis.

Experiments dealing with the influence of wastewater from 2 sugar factories in Czechoslovakia on some representative intestinal bacteria (*Escherichia coli*, *Citrobacter freundii*, *Enterobacter aerogenes*, *Salmonella anatum*, *S. schottmuelleri*, *S. typhimurium*, *Shigella sonnei* and *Streptococcus faecalis*) are reported. Experiments were carried out at 30 degrees, 20 degrees and 10 degrees C. Presterilized sugar factory wastewater caused rapid multiplication of *E. coli*, *C. freundii*, *E. aerogenes*, *S. anatum*, *S. schottmuelleri* and *S. typhimurium*, but less for *S. sonnei* and *S. faecalis* at 30 degrees, 20 degrees and 10 degrees C. The intensity of multiplication was directly proportional to the concentration of wastewater and was effective up to the dilution of 1:1000 (diluted with presterilized surface water).--Copyright 1978, Biological Abstracts, Inc. W78-07223

**EFFECTS OF STREAM CHANNELIZATION ON TERRESTRIAL WILDLIFE AND THEIR HABITATS IN THE BUENA VISTA MARSH, WISCONSIN.**  
Wisconsin Cooperative Fishery Research Unit, Stevens Point.  
For primary bibliographic entry see Field 6G.  
W78-07228

**DETOXIFICATION OF STAPHYLOCOCCAL-ENTEROTOXIN B IN WATER (IN GERMAN).**  
Wehrwiss. Dienststelle Bunsstelle Bundeswehr ABC-Schutz, Muenster (West Germany).  
For primary bibliographic entry see Field 5F.  
W78-07232

**STABLE NITROGEN-CONTAINING DISSOLVED ORGANIC SUBSTANCE IN LAKE SCHOEESSEE AND IN CULTURES OF ALGAE (IN GERMAN).**  
Bayerische fuer Landesamt Wasserwirtschaft, Munich (West Germany).  
For primary bibliographic entry see Field 5B.  
W78-07260

**VIRUSES IN WATER: THE INCREASING URGENCY OF THE PROBLEM AND APPROACHES TO ITS SOLUTION (IN RUSSIAN).**  
For primary bibliographic entry see Field 5G.  
W78-07261

**NITROGEN TRANSFORMATION IN LAKES.**  
Danish Soil Conservation Service, Viborg. Research Dept.  
V. Larsen.  
Progressive Water Technology, Vol. 8, No. 4-5, p 419-430. 10 fig, 7 tab, 16 ref. (1977).

Descriptors: \*Nitrogen, \*Denitrification, \*Denmark, \*Lakes, \*Trophic level, Eutrophication, Ammonium, Nitrates, Nitrites, Dissolved oxygen, Nitrification, Organic matter, Thermal stratification, Water temperature, Oxidation-reduction potential, Nitrogen budget.

Nitrogen transformation, especially denitrification, was investigated in 1971-72 in five Swedish lakes, ranging from deep, stratified lakes to shallow lakes without a stable stratification. Lakes Hald, Viborg Nr., and Tjele Langsøe are eutrophic, Glenstrup in meso-eutrophic, and Viborg Sdr. is polytrophic. Ammonium release from organic nitrogen begins in early spring with increased water temperature. When the temperature reaches about 4-6.5C nitrification begins, and a maximum nitrate concentration is reached by June-July at a dissolved oxygen level of about 1.5

mg/l; nitrification ceases at this point. With a further reduction in DO to 0-0.2 mg/l, denitrification begins. When thermal stratification causes oxygen depletion the only nitrate pathways are nitrate reduction and denitrification. Nitrate reduction rates, measured by 15N technique varied from 0.06-15.35 micrograms N/liter/day, and depended on temperature and organic matter content. Denitrification rates, which are temperature-dependent, varied from 3-75 micrograms N/liter/day. Denitrification strongly affected nitrate removal in the hypolimnion. Utilization of ammonium by algae as a protein source was 4-28 times more effective than utilization of nitrate. Nutrient budgets indicated that denitrification acts as an important nitrogen sink; to some extent this process makes the lakes self-regulating with respect to nitrogen content. (Lynch-Wisconsin) W78-07262

**METHOD OF AVERAGE BIRTH AND DEATH RATE EVALUATION IN THE MARINE-TERRESTRIAL BACTERIA INTERACTIONS.**  
Santiago Univ. (Spain). Dept. of Microbiology.  
J. L. Barja, T. P. Nieto, and J. Barja.  
Revue Internationale d'Océanographie Médicale, Vol. 47, p 199-202, 1977. 1 fig, 1 tab, 15 ref.

Descriptors: \*Pathogenic bacteria, \*Water pollution control, \*Birth rate, \*Death rate, \*Model studies, Mortality, Reproduction, Spain, Sea water, Mathematical models, Coliforms, *E. coli*, *Pseudomonas*, *Serratia marcescens*, *Enterobacter aerogenes*, *Bacteria*, Saprophytic bacteria, Equations, Population.

A mathematical model for evaluating variations in average birth and death rates in terrestrial pathogenic and saprophytic bacteria in seawater, derived from Pearl's growth curve, was applied to terrestrial bacteria and marine bacteria isolated from waters off the northwest coast of Spain, in order to measure activity of the latter against the former bacteria. Dilution and sedimentation alone do not explain the rapid disappearance of pollution-derived bacteria (such as coliforms) from seawater, and it has been suggested that antibiotic action by normal marine flora are most probably the cause. Results of these experiments: (1) About 35% of the marine bacteria were active against the terrestrial bacteria, and modified their birth and death rates. (2) There were no significant differences in growth rate between *Enterobacter aerogenes* exposed to *Pseudomonas* sp. and in the control. (3) The death rate of *Serratia marcescens* increased with respect to the control, but the birth rate was unaffected. (4) *Escherichia coli* had a lower death rate than in the control and increased in numbers. (Lynch-Wisconsin) W78-07263

**IBM 1130 COMPUTATION PROCESS IN THE STUDY OF BIOPHYSICAL CONSTANTS VARIATIONS OF PATHOGENOUS BACTERIA BY PHYTOPLANKTON.**  
Santiago Univ. (Spain). Dept. of Microbiology.  
B. Mora, I. Bernardez, and B. Regueiro.  
Revue Internationale d'Océanographie Médicale, Vol. 47, p 203-208, 1977. 1 fig, 1 ref, 17 ref.

Descriptors: \*Pathogenic bacteria, \*Model studies, \*Birth rate, \*Death rate, \*Phytoplankton, \*Growth rates, *Nitzschia asicularis*, *E. coli*, *Pseudomonas aeruginosa*, *Pseudomonas fluorescens*, *Serratia marcescens*, *Bacterioides*, Toxins, \*Computer programs, Mathematical models, Spain, *Bacteria*, Algae, *Bacillariophyceae*, Acetone, Sea water.

Antibiotic effects of the phytoplankton *Nitzschia asicularis* on birth and death rates of four pathogenic bacteria were studied using computer analysis. The bacteria, obtained from Galicia General Hospital, Spain, were *Escherichia coli*, *Pseudomonas aeruginosa*, *P. fluorescens*, and *Serratia marcescens*. Numerous marine plankters

form bactericidal compounds, among which planktonic algae probably are the most important. Acetonic cell extract of the *Bacillariophyceae* *N. asicularis* in organic solvents was tested on the four bacteria. Bacterial growth was determined by measuring absorbance (1-transmittance) at 530 nm in a Coleman 6/20 spectrophotometer. A statistical program and analytical procedure described by Barja, et. al. (1977) was used. Results: (1) An increase in the birth rate of *E. coli* with addition of the acetonic extract, coupled with a stable death rate, resulted in greater final population density. (2) *P. aeruginosa* did not differ significantly from the control in birth rate, but showed a significant decline in death rate, resulting in a higher final population density. (3) *P. fluorescens* experienced both a decline in birth rate, though not significant to 95%, and an increase in death rate, significant to 99.5%. (4) *S. marcescens* was not affected by the extract. An extract of methanol was also tested, but no results reached the 95% significance level. (Lynch-Wisconsin) W78-07264

**INVESTIGATION OF OIL POLLUTION ON THE POLISH BALTIC COAST IN 1974/1975 (IN POLISH).**  
Wyzsza Szkoła Pedagogiczna, Gdansk (Poland). Inst. of Biology.  
For primary bibliographic entry see Field 5B.  
W78-07265

**MICROBIOLOGICAL ASPECTS OF POLLUTION AND SELF-PURIFICATION OF THE WATER OF THE RIVER DANUBE ON ITS CZECHOSLOVAK SECTION (IN GERMAN).**  
Vyskumny Ustav Onkologicky, Bratislava (Czechoslovakia).  
B. Trzilova, and L. Miklosovicova.  
Arch Hydrobiol Supplement 52(1), p 106-115, 1977.

Descriptors: \*Self purification, \*Sugarbeets, \*Microbiology, \*River Danube (Czechoslovakia), Water quality.

On the basis of a complex microbiological characteristic, the present water quality in the river Danube on Czechoslovak territory was determined. According to general microbiological indicators, the investigated biotope may be classified into the 2nd class of cleanliness (corresponding to physical, chemical and biological data). Seasonal deterioration comes about in the sugar-beet season and the self-purification process is proved in the Czechoslovak section of river Danube.--Copyright 1978, Biological Abstracts, Inc. W78-07267

**HYGIENIC EVALUATION OF EFFECTIVENESS OF URBAN SEWAGE PURIFICATION IN OXIDATION PONDS (IN RUSSIAN).**  
Kiev Research Inst. of General Communal Hygiene (USSR).  
For primary bibliographic entry see Field 5D.  
W78-07270

**TAXONOMIC STUDIES ON AQUATIC PHYCOMYCETES, I. LEMONNIERA DE WILDEMAN.**  
Exeter Univ., (England). Dept. of Biological Sciences.  
For primary bibliographic entry see Field 5A.  
W78-07271

**STABILITY IN DRINKING AND SURFACE WATER OF NINE VIRUS SPECIES FROM DIFFERENT GENERA (IN GERMAN).**  
Institut fuer Medizinische Mikrobiologische Infekt.-Seuchenmed., Munich (West Germany).  
H. Mahnel, K. Ottis, and M. Herlyn.  
Zentralbl Bakteriell Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Betriebshyg Praev Med 164(1/2), p 64-84, 1977.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**Descriptors:** \*Potable water, \*Viruses, Public health, Canine hep, Adenovirus, Alphavirus, Arbovirus, Aujeszky virus, Foot-and-mouth disease virus, Herpesvirus, Newcastle disease virus, Paramyxovirus, Picornaviruses, Poxvirus, Reovirus, Rhabdovirus, Sindbis virus, Teschen virus, Togavirus, Vaccinia virus, Vesicular stomatitis virus.

The stabilities of Aujeszky virus (AV), Sindbis virus (SV), vesicular stomatitis virus (VSV), Newcastle disease virus (NDV), vaccinia virus (VV), foot-and-mouth disease virus (FMDV), canine hepatitis virus (CHV), reovirus (RV) and Teschen virus (TV) in drinking water and surface waters were compared. At 0-15 degrees C most viruses were stable in natural waters for long times: TV, VV, RV, CHV and NDV persisted for longer than 200 days, and FMDV, AV, VSV, and SV averaged 20-50 days.—Copyright 1978, Biological Abstracts, Inc. W78-07272

#### PHOTORESPIRATION IN LARGER LITTORAL ALGAE

Exter Univ. (England). Dept. of Biological Sciences. S. Coughlan, and D. Tattersfield. Botanical Magazine, Vol. 20, No. 4, p 265-266, 1977. 1 fig, 8 ref.

**Descriptors:** \*Algae, \*Photorepiration, \*Littoral, \*Tidal effects, \*Treadur Bay (United Kingdom), United Kingdom, Wales, \*Photosynthesis, Carbon dioxide, Temperature, Phaeophyta, Rhodophyta, Chlorophyta, Intertidal areas.

Carbon dioxide compensation points of several littoral algae collected at Treadur Bay, Anglesey, Wales, were measured. Plants were allowed to photosynthesize respired carbon dioxide to a constant level at temperatures from 0-30C in a closed leaf chamber, and carbon dioxide levels were monitored with an infrared gas analyzer. Values were uniformly low (0-10 ng/cu m) over the entire range, indicating low photorepiration. As photosynthetic rates cannot be directly measured in a closed system due to constantly changing carbon dioxide levels, there is no direct way of knowing whether normal photosynthesis was taking place, or whether the temperature changes caused stress on the algae. A variety of larger littoral algae are known to photosynthesize during the part of the tidal cycle when they are exposed to air, until the onset of desiccation, with rates of carbon dioxide fixation equal to or higher than immersed photosynthesis. Algae tested in this study were Phaeophyceae (*Fucus serratus* and *Pelvetia canaliculata*), Rhodophyceae (*Porphyra umbilicalis* and *Rhodomya palmata*), and Chlorophyceae (*Enteromorpha intestinalis* and *Ulva lactuca*). (Lynch-Wisconsin) W78-07274

#### ANNUAL FLUCTUATIONS IN BIOMASS OF TAXONOMIC GROUPS OF ZOOPLANKTON IN THE CALIFORNIA CURRENT

Institute for Marine Environmental Research, Plymouth (England). J. M. Colebrook. Fishery Bulletin, Vol. 75, No. 2, p 357-368, 1977. 10 fig, 4 tab, 19 ref.

**Descriptors:** \*California current, \*Pacific Ocean, \*Zooplankton, \*Water temperature, \*Upwelling, California, Mexico, Annual biomass, Population, Distribution patterns, Coasts, Nearshore zones.

A study of fluctuations in zooplankton biomass in the California Current (Pacific Ocean) from 1955-59 indicated that increased water temperature from 1957-59 was a prime causal factor, with amount of coastal upwelling also important. Marked similarities were found in annual biomass changes across taxonomic categories and areal zones. Most northern and inshore taxonomic

categories showed the same form of annual fluctuations in biomass as did the zones, with relatively high biomass in 1955 and 1956, and low biomass in 1958 and 1959. Only Cladocera showed a negative relationship. These results indicate that causes of the fluctuations originated either in the north of the survey area or had a greater effect on categories with northern distribution patterns. Zooplankton were divided into the following 17 categories, chosen to represent quality and quantity of zooplankton as food for fish rather than as indicators of variability: Amphipoda, Chaetognatha, Cladocera, Copepoda, Crustacea larvae, Ctenophora, Decapoda, Euphausiacea, Heteropoda, Larvacea, Medusae, Mysidacea, Ostracoda, Pteropoda, Radiolaria, Siphonophora, and Thaliacea. Principal components analysis was used to produce concise descriptions of major elements in abundance fluctuations in each of 14 zones of the survey area. Collecting was done from the surface to a depth of 140 ft. (Lynch-Wisconsin) W78-07275

#### BACKGROUND ECOLOGY AND THE EFFECTS OF NUTRIENT ADDITIONS ON A CENTRAL MICHIGAN WETLAND

Michigan Univ., Ann Arbor, School of Natural Resources. C. J. Richardson, J. A. Kadlec, W. A. Wentz, J. P. M. Chamie, and R. H. Kadlec. Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 336, Price codes: A04 in paper copy, A01 in microfiche. Wetlands Ecosystem Research Group, Publication Number Four, June, 1975. 52 p, 17 fig, 7 tab, 43 ref. \$4.50.

**Descriptors:** \*Wetlands, \*Michigan, \*Sewage treatment, \*Marsh plants, \*Biological treatment, Peat, Primary productivity, Aquatic plants, Sewage disposal, \*Waste water treatment, \*Nutrients, Plant growth, Biological communities, Water quality.

Experiments were conducted to determine the effects of nutrient additions on various wetland ecosystem components to test the feasibility of using wetlands to remove nutrients from secondary treated sewage. The magnitude of changes were determined for the structure and function of the wetland ecosystem, net primary production, nutrient uptake and transfers, water quality, and decomposition rates. The slow rate of subsurface movement, the high denitrification rates for waterlogged soils, the high nutrients absorption capacity of organic litter and peat soils and nutrient uptake by some plant species all indicate that peatland ecosystem has potential as a biological filter for plant nutrients. With fertilization, the growth of some species will be enhanced, tissue nutrient concentrations will be increased, a few species (aster and some grasses) may be adversely affected, and the litter and organic soil will function as a nutrient sink. (Steiner-Mass) W78-07279

#### EVOLUTIONARY STUDIES ON THE SHAPE OF THE CELL AND OF THE CHLOROPLAST IN DESMIDS

Lund Univ. (Sweden). Limnological Inst. For primary bibliographic entry see Field 21. W78-07283

#### MORPHOLOGICAL INVESTIGATIONS OF ASYMMETRY IN DESMIDS

Lund Univ. (Sweden). Limnological Inst. For primary bibliographic entry see Field 21. W78-07284

#### EULIMNION, AN ORIGINAL PLACE OF NEW FORMS

Lund Univ. (Sweden). Limnological Inst. E. Teiling.

Verhandlungen, Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Vol 13, p 879-882, February 1958. 5 fig.

**Descriptors:** \*Eulimnion, \*Desmids, \*Algae, \*Evolution, \*Phytoplankton, Trophic level, Oligotrophy, Lakes, Diatoms, Pelagic organisms, Endemism, \*Sweden, Speciation.

Investigation of phytoplankton in several hundred Swedish lakes has provided information on the evolution of eulimnetic plankters. The planktonic, non-motile lacustrine algae are born in the lakes but derive from terraqueous algae, the original habitat of which is the littoral zone and its soil and vegetation. From this habitat terraqueous algae are brought into the pelagic zone with other sestonic material by means of waves and streams. Most sink to the bottom, but some have structures which enable them to float in the epilimnion for a time. Among these tychoplankters there is a perpetual selection of forms which are more fitted for planktonic living, giving rise to true eulimnetic plankters. Certain desmids exhibit a wide range of variation series, members of which have been distinguished as separate taxa. Two examples of evolutionary series contain spontaneous transitional members and are characterized by a trend to elongation of the processes and especially by a reduction of the coporal ornament from the terraqueous ancestor's richness in granules and verrucae to quite smooth planktonic forms. These changes should be considered mutations favored by natural selection. The loss of ornament, and therefore weight, together with elongation of the processes assist in retarding sinking. *Xanthidium antilopaeum* typus dimazum, common in oligotrophic Swedish lakes, shows an extensive variation. More limited endemism is found in planktonic diatoms, such as *Tabellaria flocculosa*. (Lynch-Wisconsin) W78-07285

#### ROLE OF PLANKTON IN THE BEHAVIOR OF TC99 AND MN54 IN SEAWATER

V. N. Tkhomirov, V. V. Gromov, and R. N. Bernovskaya.

Available from the National Technical Information Service, Springfield, VA 22161 as BNWL-TR-169, Price codes: A02 in paper copy, A01 in microfiche. Report BNWL-TR-169, March 4, 1976, from Proceedings of the Academy of Sciences U.S.S.R., 1970, Vol 194, No 2, p 445-447. 3 tab, 2 ref.

**Descriptors:** \*Translocation, \*Phytoplankton, \*Zooplankton, \*Manganese, \*Technetium, \*Radioisotopes, \*Path of pollutants, Sea water, Pacific Ocean, Water pollution, Pollutants, Diatoms, Absorption, Photosynthesis, Oceans.

Phytoplankton and zooplankton specimens collected on a 46-month Pacific Ocean voyage were tested for absorption of the radioisotopes technetium-99 and manganese-54 to provide data on element migration regularity in a marine environment. The phytoplankton sample was dominated by diatoms, principally *Rhizosolenia*. Peridinium (flagellar seaweed) were rarely found. The zooplankton sample consisted of crustacea, radiolaria, foraminifera, and protozoa. Plankton were extracted from 15,000 liters of water, diluted to 0.06 g wet weight per liter of water, and the isotopes were added. Each solution was put into three vials: (1) one vial was kept dark to determine the consumption of elements during bacterial synthesis; (2) to another vial was added 10 micrograms of Fe(3+) per liter to control hydrogen ion effects; (3) the third vial was a control. Results showed substantial absorption of the radioelements by the plankton, increased further in the presence of iron isotopes. Technetium-99 was absorbed less by phytoplankton than by zooplankton. The ability of plankton to absorb the isotopes decreased in the absence of photosynthesis in the dark vials, particularly in the case of manganese-54 which was absorbed more by phytoplankton

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

than zooplankton. With ultrafiltration of seawater after plankton separation, both isotopes formed colloids with a particle size greater than 0.1 micrometers. (Lynch-Wisconsin)  
W78-07286

**WEST POINT LAKE POSTIMPOUNDMENT STUDY.**  
Environmental Protection Agency, Athens, GA. Surveillance and Analysis Div.  
H. C. Vick, D. W. Hill, R. J. Brune, III, T. O. Barnwell, Jr., and R. L. Raschke.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 939. Price codes: A10 in paper copy, A01 in microfiche. Report EPA-904/9-77-004, November 1976. 90 p, 22 fig, 18 tab, 16 ref, 5 append. EPA 904/9-77-004.

**Descriptors:** \*West Point Lake(GA), \*Impoundments, \*Multiple-purpose reservoirs, \*Eutrophication, \*Chattahoochee River(GA), Georgia, Lakes, Baseline studies, Basic data collections, Water quality, Nutrients, Model studies, Trophic level, Cofferdams, Phosphorus, Water temperature, Coliforms.

A preliminary postimpoundment study was conducted spring through fall 1975 in West Point Lake, 100 mi below Atlanta, Georgia on the Chattahoochee River, to assess water quality and eutrophication potential. The lake was formed by closure of West Point Dam in October 1974; concern for potential effects of upstream metropolitan areas prompted this study. The lake's waters are highly productive; Vollenwieder, Dillon, and Larsen-Mercier phosphorus-based models predict the lake will become highly eutrophic, although 95% reduction in phosphorus loadings from Atlanta will produce more mesotrophic conditions within the eutrophic classification. Acute dissolved iron and manganese problems have been encountered in downstream water supplies, partially alleviated by a portion of a coffer dam left in place 375 ft above the turbine penstocks. Downstream water temperatures are not significantly altered by the impoundment, probably due to partial blockage of colder hypolimnetic water by the submerged coffer dam (the top edge is 50 ft below the water surface). No problem is foreseen in meeting fecal coliform standards for recreational water quality; nor are there major problems with pesticides or toxic metals. The lake should start stratifying at the downstream end by April, with destratification to occur by late September. Extensive data is included in tables and charts. (Lynch-Wisconsin)  
W78-07287

**COPEPOD4: A DISCRETE TIME-DELAY MODEL OF COPEPOD POPULATION DYNAMICS.**  
Oak Ridge National Lab., TN., Environmental Sciences Div.  
For primary bibliographic entry see Field 5B.  
W78-07289

**A GENERALIZED WATER QUALITY MODEL FOR EUTROPHIC LAKES AND RESERVOIRS.**  
Battelle Pacific Northwest Lab., Richland, WA. R. G. Bacina, M. W. Lorenzen, R. D. Mudd, and L. V. Kimmel.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 925. Price codes: A07 in paper copy, A01 in microfiche. Prepared for Environmental Protection Agency, Washington, D.C., Office of Research and Monitoring. November 1974. 140 p, 70 fig, 3 tab, 45 ref, 1 append. 211B01602.

**Descriptors:** \*Model studies, \*Eutrophication, \*Reservoirs, \*Water pollution control, \*Decision-making, \*American Falls Reservoir(ID), Planning, Mathematical models, Idaho, Lakes, Simulation analysis, Water management(Applied), Trophic level, Dissolved oxygen, Biochemical oxygen demand, Water temperature, Water quality control,

Nutrients, Seasonal, Solar radiation, Coliforms, Toxins, Algae.

A multisegment deep reservoir water quality simulation model was developed for the U.S. Environmental Protection Agency and applied to American Falls Reservoir, Idaho. A hydrothermal submodel accurately predicts vertical temperature profiles with little or no subjective effort and requires only standard meteorological data to predict seasonal temperature variations. A water quality submodel simulates natural seasonal patterns of algal growth and death and nutrient cycling, and predicts DO-BOD dynamics in reservoirs and impoundments. Principal environmental variables: (1) water flows, (2) temperature, (3) solar radiation, (4) dissolved oxygen, (5) total and benthic BOD, (6) phytoplankton, (7) zooplankton, (8) nitrogen and phosphorus, (9) toxic material, and (10) coliform bacteria. Data used in modelling American Falls Reservoir is included in this report, along with results of sensitivity analyses and model performance. Model results were found to be most sensitive to algal sinking velocities, benthic BOD, and diffusion coefficients than to other model parameters. Potential applications are: (1) assessing future trophic state of reservoirs and lakes as a function of nutrient inputs, waste loadings, and hydraulic and hydrologic site characteristics; (2) waste allocation studies; (3) waste discharge effects; (4) reservoir operation management; (5) preimpoundment analyses; and (6) nutrient diversion and lake recovery studies. (Lynch-Wisconsin)  
W78-07290

**RESTORATION OF LOWER ST. REGIS LAKE (FRANKLIN COUNTY, NEW YORK).**  
New York State Dept. of Health, Albany. Environmental Health Center.  
For primary bibliographic entry see Field 5G.  
W78-07291

**USE OF ZOOPLANKTOPHAGIC FISHES IN CHANNEL CATFISH PRODUCTION PONDS.**  
Southern Illinois Univ. at Carbondale. Fisheries Research Lab.  
W. M. Lewis.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 827. Price codes: A03 in paper copy, A01 in microfiche. Completion Report for Period December 16, 1974-December 15, 1975, prepared for Illinois Department of Conservation and National Oceanic and Atmospheric Administration, April 1976. 97 p, 18 fig, 3 tab, 17 ref, 3 append.

**Descriptors:** \*Zooplankton, \*Channel catfish, \*Oxygen depletion, \*Sunfishes, \*Fish farming, \*Biocontrol, Fish management, Dissolved oxygen, Fish, Aeration, Aquaculture, Ponds, Oxygen demand, Biochemical oxygen demand, White amur, Algal control, Phytoplankton.

An attempt to determine the relationship between zooplankton population and oxygen depletion in channel catfish production ponds proved inconclusive, due to selective feeding by zooplanktophagic hybrid sunfish introduced into the ponds. The bluegill/green sunfish hybrids were added to three of the six ponds at a rate of 93,900 fish/ha. The sunfish fed primarily on large zooplankters (Calanoida and Cyclopoida). This resulted in an overall increase in the numbers of small zooplankters (Bosmina, Filinia, and Keratella). Oxygen reached critically low levels in the ponds despite the sunfish; it was affected by the change in zooplankton composition, but not necessarily favorably. The most valuable observation related to oxygen production-consumption analyses was based on sunrise-sunset readings; it was found that oxygen production and consumption were of similar magnitude, suggesting a type of respiratory dependence. Little hope is seen for identifying a single mechanism which triggers depletion of oxygen; certain measures can, however, reduce the

likelihood or effects of depletion, including limiting feed to 34 kg/ha/day, providing a refuge of oxygenated water, and selective artificial oxygenation of the pond. It is thought that high zooplankton populations may cause oxygen depletion because zooplankton foraging would reduce the phytoplankton population, decreasing oxygen production. (Lynch-Wisconsin)  
W78-07292

**NORTHERN PIKE PRODUCTION IN MANAGED SPAWNING AND REARING MARSHES.**  
Wisconsin Dept. of Natural Resources, Madison. Bureau of Research.  
D. M. Fago.  
Technical Bulletin No. 96, 1977. 30 p, 11 fig, 15 tab, 28 ref.

**Descriptors:** \*Fish management, \*Northern pike, \*Spawning, \*Fish hatcheries, \*Fish stocking, \*Fish reproduction, Fish, Esox lucius, Pikes, Pleasant Lake Marsh(WI), Pabst Marsh(WI), Wisconsin, Water temperature, Dissolved oxygen, Zooplankton, Habitats, Computer programs.

Two southeastern Wisconsin marshes were studied to assess factors affecting production of fingerling northern pike (Esox lucius) in managed fish spawning and rearing areas. Important factors included: (1) water temperature and dissolved oxygen during draining of the marsh; (2) cannibalism during the fingerling stage; and (3) zooplankton composition during the fry stage. Ditching, draining, and diking near lakes in Wisconsin have resulted in loss of marshy areas considered likely northern pike spawning sites. The two study areas were 1.5-ha Pleasant Lake Marsh, studied from 1969-73, and 7.5-ha Pabst Marsh, studied 1971-72. Both marshes were filled by pumping to a depth of 2-4 ft at the end of March, the water level maintained for about nine weeks, and the marshes drained and fingerlings collected. Spawning stock was obtained from three lakes in Dodge and Winnebago counties and released into the marshes. After spawn removal of adults was attempted using fyke nets to reduce predation on the fingerlings. Annual production from Pleasant Lake Marsh was 131-1312 fingerlings/ha, and from Pabst Marsh 276-426/ha. Average production from both marshes was 539 fingerlings/ha, with an average length of 88.9 mm (range 38-173 mm). Weight produced was 2.5-18.3 kg/ha, an average of 11.9 kg/ha. Estimated survival from egg deposition to draining was 0.15-2.69% (average 1.09%). Suitable spawning marshes should be completely drainable, preferably into the lake to be stocked. (Lynch-Wisconsin)  
W78-07293

**ROLE OF HIGHER AQUATIC VEGETATION IN THE ACCUMULATION OF ORGANIC AND BIOGENIC SUBSTANCES IN INLAND WATERS.**  
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.

Yu. G. Maystrenko, A. I. Denisova, V. M. Bagnyuk, and Ah. M. Aryamova.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A037 659. Price codes: A02 in paper copy, A01 in microfiche. Draft Translation 607, March 1977. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Translated from *Gidrobiologicheskii Zhurnal*, Vol. 5, No. 6, 1969, p 28-39. 2 fig, 3 tab, 13 ref.

**Descriptors:** \*Kiev Reservoir(U.S.S.R.), \*Aquatic plants, \*Mineralization, \*Nitrification, \*Degradation(Decomposition), \*Organic matter, \*Biogenic substances, \*Denitrification, Soviet Union, Carbon, Nitrogen, Bacteria, \*Decomposing organic matter, Reservoirs, Oxygen, Anaerobic conditions, Carbon dioxide.



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

An experimental study of the decomposition of higher aquatic plants in the Kiev Reservoir, Soviet Union, concludes that such vegetation, after dying, degrading, and mineralizing, serves as a prime source of organic and biogenic substances accumulating in water. With plant wet weight of up to 10 g/l of water, oxygen substantially deteriorates during the first days, and anaerobic conditions resulting from mineralization of plant remains persist for 25-120 days. The water accumulates a large amount of biochemically-unstable organic compounds and in it saprophytic, proteolytic, ammonifying, and denitrifying bacteria develop intensively. As carbon-nitrogen ratios narrow, ammonia nitrogen accumulates, and the content of carbon dioxide and mineral derivatives of nitrogen and phosphorus increases. The count of saprophytic microorganisms and the rate of accumulation of organic and biogenic substances are highest in the first 20 days of plant contact with water. By the second month of mineralization the amount of biochemically-stable organic substances rises, the carbon-nitrogen ratio becomes larger, there is a decrease in the content of saprophytic, proteolytic, anaerobic, cellulosic and ammonifying bacteria, and nitrification intensifies. At maximum release of organic and biogenic substances, the content of organic nitrogen and carbon exceeds the background values by 1.3-10 times, and the content of mineral derivatives of nitrogen and phosphorus by 11-70 times. (Lynch-Wisconsin)

W78-07294

**ANTECEDENT EVENT INFLUENCE ON BENTHIC MARINE ALGAL STANDING CROPS IN HAWAII.**  
Hawaii Univ., Honolulu. Dept. of Botany.  
For primary bibliographic entry see Field 2L.  
W78-07295

**THE UTILIZATION OF DISSOLVED ORGANIC COMPOUNDS IN AQUATIC ENVIRONMENTS.**  
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).  
A. B. J. Sepers.  
Hydrobiologia, Vol. 52, No. 1, January 1977, p 39-54, 3 tab, 134 ref.

Descriptors: \*Dissolved organic matter (DOM), \*Organic compounds, \*Nutrient requirements, \*Bacteria, \*Phytoplankton, \*Invertebrates, Absorption, Coelenterates, Annelids, Mollusks, Pogonophores, Algae, Substrates, Nutrients, Carbon, Organic matter.

Published data was used to evaluate the importance of dissolved organic matter (DOM) as a nutritional source for invertebrates, phytoplankton, and bacteria. Heterotrophic bacterial DOM uptake is specially adapted to very low substrate concentrations; comparison of bacterial DOM uptake with that of invertebrates and phytoplankton indicates that, given low substrate levels, DOM uptake in natural waters is primarily a bacterial process and occurs in low amounts. In surface layers of the open sea concentrations range from 0.5-3.0 mg C/l, in deeper parts 30-50% lower and in coastal areas and upwelling regions higher. Sediment interstitial water contains 50-150 mg C/l as DOM. Many marine invertebrates are able to take up DOM from the ambient seawater; uptake is a surface-related phenomenon and is mediated by an active transport process. In freshwater invertebrates DOM uptake proceeds at a considerably lower rate or does not occur. DOM may be incompatible with chloride- and osmoregulatory processes, but may have some nutritional value during shortages of particulate food. Only pogonophores can rely totally on DOM for nutrient requirements. Some phytoplankters can grow heterotrophically in the dark using dissolved organic substrates as a carbon and energy source, but such conditions are very restricted. Many algae can take up DOM in the light, mediated by an active transport system. (Lynch-Wisconsin)

W78-07296

### MARINE POLLUTION HAZARDS.

Southern California Univ., Los Angeles. Dept. of Biological Sciences.  
B. C. Abbott.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 110. Price codes: A02 in paper copy, A01 in microfiche. Office of Naval Research, November 1975, 22p. NR 202-0501 2-4-75 (442), N00014-67-A-0269-0017.

Descriptors: \*Water pollution effects, \*Red tide, \*Dinoflagellates, \*Gymnodinium breve, \*Gonyaulax polyhedra, \*Los Angeles (CA), \*Eutrophication, California, Florida, Coasts, Algae, Toxins, Toxicity, Lethal limit, Fishkill, Harbors, Nutrients, Gulf of Mexico, Gymbretoxin.

Two dinoflagellate species responsible for red tides in U.S. coastal waters are *Gymnodinium breve*, the cause of fishkills in the Gulf of Mexico off Florida, and *Gonyaulax polyhedra*, the major cause of red tides in the Los Angeles and Long Beach (California) harbors. Studies of *Gymnodinium breve* have resulted in identification of two major biologically active compounds: gymbretoxin, a potent enurotoxin, and an intracellular hemolytic component. Gymbretoxin acts specifically on excitable membranes on the site of the active sodium channels; and it competes with the calcium ion on the resting membrane, moving the sodium inactivation curve along the axis of membrane potential and lowering the accommodation level. The crude toxin is lethal to all vertebrates at low concentrations. The second compound has a far more intensive hemolytic action on fish than on mammalian red blood cells. As background for the *Gonyaulax polyhedra* investigations, an investigation was undertaken of biotic and abiotic influences on red tide occurrences in the Los Angeles-Long Beach harbors through a cooperative baseline survey and monitoring program. The monthly sampling program, begun in 1971 and involving 43 stations, has been completed. The Los Angeles River channel was an unexpectedly important source of pollutants. An extensive fauna has developed in the harbor since enforcement of water quality standards in 1969-70. (Lynch-Wisconsin)

W78-07297

### THE EFFECT OF CHEMICALS ON SOME MICROBIAL SELF-PURIFICATION PROCESSES IN BODIES OF WATER (IN RUSSIAN).

Moskovskii Gosudarstvennyi Meditsinskii Inst. (I) (USSR). Dept. of General Hygiene.  
G. A. Bagdasaryan, A. E. Nedachin, and T. V. Doskina.  
Gig Sanit 2, p 104-106, 1977.

Descriptors: \*Self purification, \*Coliphages, \*Viruses, Microbiology, Water purification, Bioindicators, Water pollution, \*Chemical wastes, \*Bdellovibrio-bacteriovorus, Enterovirus, \*E. coli, Petroleum products, Picornavirus, Surfactants.

The effect of chemicals in commercial and household wastes (petroleum products, surfactants) on levels of enteroviruses, *Escherichia coli*, coliphages and *Bdellovibrio bacteriovorus* was studied under natural conditions. Both viruses were more resistant to the chemicals than *E. coli* and *B. bacteriovorus*. The retarded inactivation of the enteroviruses was evidently associated with the depression of natural purification processes, as evidenced by the reduction of *B. bacteriovorus* activity. The coliphage level was virtually unaffected, indicating its value as an index of environmental contamination. Copyright 1978. Biological Abstracts, Inc.

W78-07298

**MACROBENTHOS OF THE TIDAL DELAWARE RIVER BETWEEN TRENTON AND BURLINGTON, NEW JERSEY.**  
Ichthyological Associates, Inc., Middletown, DE.  
S. E. Crumb.  
Chesapeake Science, Vol. 18, No. 3, September 1977, p 253-265. 5 fig, 1 tab, 38 ref.

Descriptors: \*Macrobenthos, \*Tubificids, \*Water pollution effects, \*Delaware River, \*Eutrophication, \*Benthic fauna, \*New Jersey, Rivers, Benthos, Macroinvertebrates, Limnodrilus, Asiatic clam, Corbicula manilensis, Faunal lists, Clams, Bioindicators, Trophic level, Chironomids, Tidal streams.

A study of the density and biomass of the benthic communities of the tidal Delaware River between Burlington and Trenton, New Jersey showed that tubificids (*Limnodrilus*) were dominant, comprising over 90% of all organisms. The nearly monogenic composition of the tubificid worms, with *L. hoffmeisteri* most abundant, indicates the status of the river's water quality is somewhere between gross organic pollution and simple eutrophication. The river receives over 22 sq m/sec of domestic and industrial waste from point discharges on the main stem and diffuse discharges via tributaries. When flow at Trenton is minimal during August-September the mud bottom releases large amounts of gas, composed of 72% methane. Monthly samples were taken over the 21-km stretch of the river with Ponar or Petersen grab samplers during August 1970-October 1973. Little difference was noted among sampling sites in pH, temperature, or dissolved oxygen. Water temperature varied from 0-1°C in February to 28-33°C in August-September. Bottom DO ranged from 3-4 mg/l in August-September to 15 mg/l in February. The pH range was 7.09. Benthic fauna abundant throughout the study area were the tubificids *L. hoffmeisteri*, *L. udekemianus*, and *Pelocoxes ferox*; the chironomid larvae *Procladius culiciformis*; and the asiatic clam *Corbicula manilensis*. The latter is a biological pest first observed in the river in 1971. (Lynch-Wisconsin)

W78-07300

### THE IMPACT OF NITROGEN AND PHOSPHORUS RELEASE FROM A SILICEOUS SEDIMENT ON THE OVERLYING WATER.

Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.  
E. O. Hartwig.  
Available from the National Technical Information Service, Springfield, VA 22161 as COO-327 920. Price codes: A03 in paper copy, A01 in microfiche. Paper No. COO-3279-20, presented at the Third International Estuarine Conference, October 1975, Galveston, Texas. 33 p, 10 fig, 2 tab, 29 ref.

Descriptors: \*Phosphorus, \*Nitrogen, \*Carbon, \*Sediments, \*Nutrient flux, \*Phytoplankton, Primary productivity, La Jolla (CA), California, Bottom sediments, Nutrients, Algae, Nutrient requirements.

The nutrient exchange rate was quantified for subtidal siliceous sediments at a depth of 18.3 m in the La Jolla Bight, and the probable impact of this exchange on phytoplankton productivity in the overlying water was analyzed. Release (+) or uptake (-) of nutrients was measured by analyzing nutrient concentrations contained in a known water volume overlying a measured sediment area enclosed within plastic boxes over a predetermined time interval. Mean net exchange values and total range of rates were in micromoles/sq m/day: ammonia +872 (-47 to +3290); nitrite +34 (-5 to +97); nitrate -77 (-720 to +647); Phosphate +77 (-438 to +502); dissolved organic phosphorus +12 (-28 to +59); dissolved organic nitrogen -75 (-1326 to +1280); and dissolved organic carbon -583 (-30,800 to +23,800). Using published primary production rates and carbon-nitrogen-phosphorus

ratios it is calculated that up to 935 g of the phytoplankton biomass (micromoles N/m<sup>2</sup>/day, or 5% of phosphorus. Release of both (0.5%) already mean net and presumed that into the water phytoplankton the area. (Lynch-W78-07300)

**ANABIOIC GREEN ALGAL TRANSIENTS IN THE TENSITY.**  
Kyoto Univ.  
H. Imafuku.  
Physiologia 195, 3 fig, 18 p.

Descriptors: \*Variability, \*Photophosphorylation, \*Photosynthesis, \*Enzymes, \*Oxygen, \*Dimethylurea.

The light intensity-cyclic photophosphorylation of the same oxygen variability, to cause of photophosphorylation, incubated saturated transients of chlorophyll fluorescence evolution there was no transient unit that of fourfold, however, a high intensity lighting. The first five seconds CMU than the increase which photosynthesis for calculated photophosphorylation ATP. For a bilis were a water jacket (25°C). The projector v Wisconsin) W78-07303

**CHARACTERISTICS OF TAKE IN A BERGEN URBAN MICROBIOLOGICAL H. C. UTILITY PHYSIOLOGICAL 220. 3 fig, 18 p.**

Descriptor: \*Nutrients, \*Cyanophytes, \*Concentration, \*Light.

Sulfate uptake, invertebrate metabolism, an active



ratios it is calculated that 15,000 micromoles N/sq m/day and 935 micromoles P/sq m/day were taken up by the phytoplankton. The benthos released 786 micromoles N/sq m/day and 90 micromoles P/sq m/day, or 5% and 10% of the required nitrogen and phosphorus. Results showed, however, that sediment exchange released only an insignificant fraction of both nitrogen (0.04%) and phosphorus (0.05%) already contained in the water. Using a mean net advection rate of 1.5 km/day, it is presumed that nitrogen and phosphorus released into the water was superfluous to the needs of the phytoplankton and was therefore exported from the area. (Lynch-Wisconsin)  
W78-07302

**ANAEROBIC ATP LEVELS IN THE BLUE-GREEN ALGA ANABAENA: DARK-LIGHT TRANSIENTS AND EFFECTS OF LIGHT INTENSITY.**  
Kyoto Univ. (Japan). Dept. of Botany.  
H. Imafuku.  
Physiologia Plantarum Vol. 38, No. 3, 1976, p 191-195. 3 fig, 18 ref.

Descriptors: \*Adenosine triphosphate, \*Anabaena variabilis, \*Light intensity, \*Photophosphorylation, \*Photoinhibition, Algae, Photosynthesis, Respiration, Anaerobic conditions, Enzymes, \*Cyanophyta, Bioassay, Darkness, Oxygen, Eutrophication, \*Chlorophenyl-dimethylurea.

The light intensity dependence of two phenomena—cyclic photophosphorylation and photoinhibition of respiration—were measured simultaneously in the same organism, the cyanophyte *Anabaena variabilis*, to investigate through comparison the cause of photoinhibition of respiration. An enzymatic method was used to determine adenosine triphosphate (ATP) extracted from anaerobically incubated samples of *A. variabilis*. Dark-light-dark transients of the ATP level in the whole cells were studied in the presence and absence of 3-(p-chlorophenyl)-1,1-dimethylurea (CMU). When oxygen evolution was completely inhibited by CMU, there was no significant difference between the transient under illumination of a low intensity and that of fourfold intensity. In the absence of CMU, however, ATP level decreased more rapidly after high intensity illumination than after low intensity lighting. The increase in ATP content during the first five seconds illumination was smaller without CMU than in its presence. With or without CMU the increase was saturated near the intensity at which photosynthetic oxygen evolution compensates for respiratory oxygen consumption. The calculated quantum requirement of cyclic photophosphorylation in vivo was 2.2 quanta per ATP. For ATP assays, washed cells of *A. variabilis* were placed in an 8-mm thick vessel having a water jacket to maintain constant temperature (25°C). The vessel was illuminated on one side by a projector with a 150-W tungsten lamp. (Lynch-Wisconsin)  
W78-07303

**CHARACTERIZATION OF SULPHATE UPTAKE IN ANACYSTIS NIDULANS.**  
Bergen Univ. (Norway). Botanical Lab.; and Bergen Univ. (Norway). Inst. for General Microbiology.  
H. C. Utken, M. Haldal, and G. Knutsen.  
Physiologia Plantarum, Vol. 38, No. 3, 1976, p 217-220. 3 fig, 1 tab, 9 ref.

Descriptors: \*Sulfates, \*Absorption, \*Anacystis nidulans, \*Metabolism, \*Kinetics, Algae, \*Cyanophyta, Thiosulfate, Sulfites, Hydrogen ion concentration, Temperature, Sulfur, Energy, Light.

Sulfate uptake in the cyanophyte *Anacystis nidulans*, investigated as part of a study of sulfate metabolism in this alga, appeared to be based upon an active mechanism with a  $K_{sub m}$  of 0.75

microM and a  $V_{sub max}$  of 0.7 pmol/min x 1,000,000 cells. Uptake is competitively inhibited by thiosulfate and sulfite and has a pH optimum of 8.0 and a temperature optimum of 40°C. By increasing the extracellular sulfate concentration from 0.1 to 10 microM the sulfate pool in *Anacystis* was altered from 0.000083 M to 0.00059 M. To measure sulfate uptake kinetics, cells were harvested during exponential growth, washed twice with and transferred to sulfate-free medium, and incubated at 42°C and 14 klux. After two hrs sulfate starvation, sulfate was added. Samples were filtered, and initial sulfate uptake velocity determined by a plot of counts vs time. Sulfate uptake rate depended upon duration of sulfate starvation. The initial uptake rate increased during the first two hrs of starvation, but then no further increase occurred for five hrs of sulfate starvation. Sulfate transport in *A. nidulans* is assumed to be active because: (1) the transport system has a high affinity for its substrate (sulfate) and conforms to Michaelis-Menten kinetics; and (2) there was no uptake in the dark even though the algae were depleted of sulfate for six hrs, suggesting that sulfate uptake is energy-dependent. (Lynch-Wisconsin)  
W78-07304

**THE PROBLEM OF THE SALINITY INCREASE IN LAKE QARUN (EGYPT) AND A PROPOSED SOLUTION.**  
Alexandria Inst. of Oceanography Fisheries (Egypt).  
A. H. Meshal.  
Journal du Conseil, Conseil International pour l'Exploration de la Mer, Vol. 37, No. 2, February 1977, p 137-143. 4 fig, 4 tab, 10 ref.

Descriptors: \*Lake Qarun (Egypt), \*Salinity, \*Saline lakes, \*Water pollution control, Lakes, Egypt, Agricultural runoff, Faiyum Depression (Egypt), Lake Moeris (Egypt), Salts, Rehabilitation, Irrigation, Evaporation, Water level fluctuations.

Lake Qarun, the remnant of freshwater Lake Moeris in the Faiyum Depression of central Egypt, is now a closed saline basin expected to become a dead body of water in 75 years if salinity continues to increase at its present rate of 0.35% per year. Average salinity has increased from 11‰ in 1906 to 31.7‰ in 1970, and by 2050 the salinity could be over 60‰. Lake Qarun occupies the deepest part of the Faiyum Depression and drains all agricultural lands of Faiyum Province, a volume of 350 million cu m of water annually with an average salt content of 1.1%. Each year a nearly equal volume is lost through evaporation which leaves the dissolved salts behind. Salinity therefore continuously increases (assuming constant lake volume, which in 1970 was about 1.05 cu km). The water level in 1970 was about 43.9 m, and the lake covered an area of 240.6 sq km. Expansion of cultivated lands in the area with corresponding increased irrigation and drainage poses the problem of potential flooding as the lake's capacity is limited. Increased salinity jeopardizes the lake's fishery. Two solutions are proposed for salinity control: (1) isolate five small areas of the lake for evaporation, then allow inflow from the main body; equilibrium at 41‰ salinity would result; or (2) dam a larger portion of the lake using the same procedure; salinity of the lake proper would asymptotically approach the equilibrium value of 12.4‰ although incurring higher costs. (Lynch-Wisconsin)  
W78-07305

**THE RELATION BETWEEN ADENOSINE TRIPHOSPHATE AND MICROBIAL BIOMASS IN DIVERSE AQUATIC ECOSYSTEMS.**  
California Univ., Davis. Div. of Environmental Studies.  
H. W. Paerl, and N. J. Williams.  
Internationale Revue Der Gesamten Hydrobiologie, Vol. 61, No. 5, 1976, p 659-664. 2 fig, 1 tab, 13 ref.

Descriptors: \*Adenosine triphosphate, \*Biomass, \*Phytoplankton, \*Carbon, \*Trophic level, \*Radioactive indicators, Analytical techniques, Microorganisms, Bacteria, Depth, \*Lake Tahoe (CA NV), California, Nutrients, Lakes, Eutrophication, Indicators, Viability, Living biomass, Diatoms, Tracers, Algae.

The ratio of carbon to adenosine triphosphate (ATP) in living phytoplankton cells was consistent over depth and nutrient level in water samples from Lake Tahoe, California. The ratio fluctuated by no more than + or - 1% of the mean between maximum and minimum nutrient conditions. A survey of lakes differing in trophic level and having diverse phytoplankton and bacterial assemblages demonstrated that ATP can accurately measure total living microbial biomass. ATP discriminates living from dead or detrital material because it rapidly breaks down to mono- and diphosphate nucleotides in extracellular solution or dead cells. Only living cells, therefore, contain appreciable amounts of ATP. Results indicate that conventional phytoplankton enumeration methods tend to overestimate biomass among armored species (such as diatoms) harboring intracellular remnants from former growth periods. Previous attempts to measure carbon-ATP ratios of natural microbial communities failed because of the difficulty of separating living from nonliving components. The present study overcame this problem by autoradiographic examination of carbon-14 labelled viable cells, which allowed separation of the phytoplankton. Since both ATP determinations and labelling could be performed on natural algal communities determining carbon-ATP ratios was possible. (Lynch-Wisconsin)  
W78-07306

**SEDIMENTARY RECORD OF HEAVY METALS AND POLYCYCLIC AROMATIC HYDROCARBONS IN LAKE CONSTANCE (IN GERMAN).**  
Heidelberg Univ. (West Germany). Lab. fuer Sedimentforschung.  
For primary bibliographic entry see Field 5B.  
W78-07307

**AN IN SITU STUDY OF RECRUITMENT, GROWTH AND SURVIVAL OF SUBTIDAL MARINE ALGAE: TECHNIQUES AND PRELIMINARY RESULTS.**  
California Univ., Santa Barbara. Dept. of Biological Sciences; and California Univ., Santa Barbara. Marine Science Inst.  
M. Neushul, M. S. Foster, D. A. Cohn, J. W. Woessner, and B. W. W. Harger.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 416. Price codes: A02 in paper copy. Journal of Phycology, Vol. 12, No. 4, p 397-408, 1976. 23 fig, 2 tab, 45 ref. NSF GH-43, GH-95 and GA-27484; NOAA USDC-2-35208.

Descriptors: \*Fouling plates, \*Benthos, \*Sampling, \*Data collections, \*Testing procedures, \*Tidal waters, \*Marine algae, Pacific Ocean, Biological communities, Coasts, Colonization, Growth rates, Subtidal areas, Predation, Ecosystems, Santa Barbara (CA).

Plexiglas (20 X 20 X 0.93 cm) and concrete block (9 X 19.5 X 4 cm) fouling plates were set up 12 m deep on the ocean floor 273 m offshore from Santa Barbara, California to study colonization, growth, and survival rates of benthic marine plants and animals. The plates were subjected to the following experiments: (1) periodic removal for non-destructive microscopic examination with subsequent replacement; (2) caging (2.5 cm mesh) to deter larger predators, such as starfish, urchins, and fish; (3) sediment removal at intervals; (4) left undisturbed. The main part of the study was conducted February 1972-March 1973. Frequently-examined plates had essentially the same populations as undisturbed plates. Caged communities were very different from uncaged ones, and consisted

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

mainly of worms, barnacles, and bryozoans. Partial caging with a 2.5-cm mesh canopy affected plant species diversity through reduction of light and water motion. Sedimentation significantly affected settlement and establishment of organisms. Plant recruitment and survival rates were highest in summer, but summer-installed plates had less flora diversity than those installed in winter. Community structure was similar on plastic and concrete surfaces, but there were more layers (intercepts per intersect) on the concrete. (Lynch-Wisconsin) W78-07308

#### PHOTORESPIRATION IN MARINE PHYTOPLANKTON

Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.  
I. Morris, and J. Beardsall.  
Available from the National Technical Information Service, Springfield, VA 22161 as COO-2538-20. Price codes: A02 in paper copy, A01 in microfiche. (1976). 9 p, 1 tab, 9 ref. E(11-1)-2438.

Descriptors: \*Photorespiration, \*Phytoplankton, \*Phaeodactylum tricornutum, \*Algae, \*Photosynthesis, \*Respiration, Diatoms, Marine algae, Light, Darkness, Oxygen, Carbon dioxide, Assay, Hydrogen ion concentration, Ribulose diphosphate, Skeletonema costatum, Dunaliella tertiolecta, Conyaulax.

Two kinds of evidence are shown to suggest that photorespiration (light-stimulated respiration in photosynthetic organisms) exists in the marine diatom *Phaeodactylum tricornutum*: (1) oxygen inhibition of photosynthesis, particularly at low carbon dioxide concentrations, and (2) the presence of a ribulose diphosphate-dependent oxygenase activity in cell-free extracts. Under certain conditions photorespiration, by contrast with dark respiration, can result in a significant proportion of fixed carbon evolving as carbon dioxide. This study investigated photorespiration in *P. tricornutum* in terms of: (1) oxygen inhibition of photosynthesis; (2) oxygen inhibition of ribulose-1,5-diphosphate carboxylase (RuDP Case) activity (the enzyme responsible for primary carboxylation during photosynthesis); (3) RuDP-dependent oxygenase activity; and (4) carbon dioxide fixation during photosynthesis under high oxygen concentrations. Rate of respiration in light can be different from the rate in the dark, which is linked to the metabolism of glycolate and arises partly because oxygen competes with carbon dioxide for the RuDP Case-catalyzed reactions of ribulose-1,5-diphosphate. Conditions under which photorespiration can be significant and may affect net carbon dioxide assimilation during photosynthesis are: low carbon dioxide concentrations, high oxygen concentrations, high light intensities, high temperatures, and the previous history of the organism. (Lynch-Wisconsin) W78-07309

#### SUMMARY REPORT - THE CHOWAN RIVER PROJECT

North Carolina Water Resources Research Inst., Raleigh.  
S. Bond, G. Cook, and D. H. Howells.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 728. Price codes: A03 in paper copy, A01 in microfiche. (1978). 36 p, 25 fig, 6 ref. OWRT A-999-NC(51).

Descriptors: \*Algae, \*Algal growth, Water quality, Nitrogen, Nutrients, Aquatic plants, \*Mathematical models, Diatoms, Cyanophyta, \*Chowan River Estuary(NC), \*North Carolina.

A reliable mathematical model has been developed by the US Geological Survey for the estimation of flows in the Chowan River. River flow exerts a very strong influence on the growth of algae, which declines with rising flows and intensifies with low flows. Concentrations of nutrients and

algae vary greatly with location and time. During the summer, temperature, light, and flow are more favorable to algal growth than at any other time of the year. Because of the intensity of growth at this time, levels of nutrients dissolved in the water are sharply reduced. Nitrogen concentration is the limiting factor for algal growth in the summer. Most nitrogen assimilated by algae during this period comes from recycling processes such as regeneration of dissolved inorganic nitrogen from dead organic matter in the water and sediments. The principal types of algae in the Chowan are diatoms and blue-greens. The latter are the nuisance algae and bloom in the spring and summer. Large algal blooms are caused by two types of blue-green algae, *Anabaena* and *Anacystis*. Mathematical models have been developed to guide decision-making by water resource and water pollution control agencies. The models will help to answer such questions as the impact of growth, increased water withdrawals, more nitrogen and other wastes on water quality in the Chowan River. (Kiger-No Caro St) W78-07318

#### TEMPERATURE REQUIREMENTS OF SALMONIDS IN RELATION TO THEIR FEEDING, BIOENERGETICS, GROWTH AND BEHAVIOR

Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.  
R. M. Hughes, G. E. Davis, and E. Warren.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 807. Price codes: A03 in paper copy, A01 in microfiche. Oregon Water Resources Research Institute Corvallis, Completion Report, April 1978. 40 p, 12 fig, 1 tab, 7 ref. OWRT B-041-ORE(1).

Descriptors: \*Salmonid production, Temperature effects, Fish populations, Water pollution effects, \*Fish behavior, \*Growth rates, \*Thermal pollution, Biomass, \*Salmon, Coho salmon, Chinook salmon, Steelhead trout, \*Trout, Aquaria.

Studies were conducted of the effects of a persistent elevation of temperature above ambient levels on the food consumption and growth of juvenile salmonids held in aquaria and on the survival rates, numbers, biomass, production rates and behavior of salmonids, as well as on biological community composition in model streams. These studies were conducted from 1968 into 1977. (See also W72-05090). This report primarily covers the last phase of this research, 1975-1977, and generally confirms the results of the earlier studies, which are summarized. The salmonids investigated were coho salmon (*Oncorhynchus kisutch*), chinook salmon (*O. tshawytscha*), and steelhead trout (*Salmo gairdneri*). In aquarium studies on the food consumption and growth rates of the salmonids, temperature elevation of 34C to 78C above ambient levels of a small natural stream generally increased metabolic rate and maintenance ratios levels and reduced growth rates. Only at the highest ration levels were the growth rates of fish held at higher temperatures nearly equal to those of the controls. Persistent temperature elevation of 3-4C over ambient levels reduced survival, number, biomass, and production rates of the salmonids in the model streams. Abundance of food organisms and total macroinvertebrate biomass were reduced by temperature elevation in the model streams, with the exception of an aquatic snail, the biomass of which was increased. Macroinvertebrate diversity in the model streams was also reduced by temperature elevation in the model streams, with the exception of an aquatic snail, the biomass of which was increased. Macroinvertebrate diversity in the model streams was also reduced by temperature elevation. W78-07322

#### ECOLOGICAL COMPONENTS STRUCTURING THE SEAWARD EDGES OF TROPICAL PACIFIC REEFS: THE DISTRIBUTION, COM-

MUNITIES AND PRODUCTIVITY OF POROLITHON, California Univ. Irvine. Dept. of Population and Environmental Biology.  
For primary bibliographic entry see Field 2L. W78-07327

#### NITRIFICATION IN FOUR ACIDIC STREAMS IN SOUTHERN NEW JERSEY

Geological Survey, Trenton, NJ. Water Resources Div.  
J. C. Schornick, Jr., and N. M. Ram.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 052. Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 77-121, January 1978. 51 p, 22 fig, 9 tab, 32 ref.

Descriptors: \*Nitrification, \*Acid streams, \*Sewage effluents, \*New Jersey, \*Water analysis, Alkalinity, Hydrogen ion concentration, Water temperature, Dissolved oxygen, Bacteria, Nitrogen, Biological properties, Chemical analysis, Evaluation, \*Southern New Jersey streams, Hammon Creek, Landing Creek, Squankum Branch, Hay Stack Brook.

Four characteristically acidic streams in southern New Jersey were investigated to determine the effect of secondary effluent on nitrification in the receiving waters. Chemical and microbiological data were obtained at four sites on each stream. From these data seven factors were evaluated to determine the proclivity of each stream to nitrify. pH, water temperature, and dissolved oxygen were used to describe the general condition of the streams, while neutralization of alkalinity, nitrogen species concentration trends, biological and nitrogenous oxygen demand incubations, and nitrifying bacteria densities were used to determine the actual presence of nitrification in each stream. Each stream had a unique distribution of conditions, making it possible to qualitatively rank the streams according to their proclivity to nitrify. Hay Stack Brook shows strong evidence for nitrification on the basis of all four nitrification indicators, whereas Landing Creek showed little, if any, evidence of nitrification. Hammon Creek is apparently nitrifying, but because of the uncertainty in the downstream trends of the nitrogen species and a lower level of alkalinity neutralization, it is nitrifying less than Hay Stack Brook. Squankum Branch also showed some evidence for nitrification, mostly on the basis of the biological and nitrogenous oxygen demand incubations. Although these streams are acidic in character, acidity does not appear to be an exclusive factor in determining whether a stream will undergo nitrification. (Woodard-USGS) W78-07353

#### ADAPTATION OF COPEPOD POPULATIONS TO THERMAL STRESS, II

Maryland Univ., Baltimore County, Baltimore. Dept. of Biological Sciences.  
B. P. Bradley.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 831. Price codes: A03 in paper copy, A01 in microfiche. Maryland Water Resources Research Center, College Park, Technical Report No. 45, 21 p, 2 fig, 5 tab, 47 ref. OWRT B-021-MD(1), 14-34-0001-6085.

Descriptors: Zooplankton, \*Thermal tolerance, Adaptation, Physiology, Genetics, \*Thermal stress, \*Copepods, \*Thermal pollution, Reproduction, Chesapeake Bay, \*Eurytemora affinis.

The copepod *Eurytemora affinis* has considerable potential for both physiological and genetic adaptation to temperature stress. Physiological variance was expressed more in females and genetic variance was expressed more between males. Estimates of both variances were obtained by several methods and all gave essentially the same results. The assay method used to measure temperature

tolerance determined a term (30 min.) long-term survival of copepod population limit of survival Chesapeake Bay and laboratory cultures. This is a genetic and usable in future capacity also W75-1110 W78-07398

#### AQUATIC CONTROL

Army Engineer Vicksburg, FL. Southern For primary W78-07399

#### EFFICACY

FLIED FOR HYDRILLA Agriculture FL. Southern For primary W78-07400

#### DISTRIBUTION

PHOSPHOR MYRIOPHYLLUM MICHX. HAMPSHIRE New Hampshire Plant E. C. Penn Available tion Service Price code Master of 69 fig, 18 0001-5029.

Descriptor plant con \*Phosphat sources, A Substrate: lum Microphytes kee(NH).

Myriophy described in the litt tribut, habitat present in wave action the stand colonizat through phosphor seasonall weight du sue phosph a marked heteroph from Ap growth rate cm/day. of shoot levels in (Gerloff) uptake phosphor growth growth concent released W78-074

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

tolerance depended on time to enter a coma following a temperature shock. The assay was short-term (30 min. maximum) but was closely related to long-term survival in high temperatures. The copepod populations seem to be at or near their limit of survival in summer temperatures in the Chesapeake Bay, judging by field observations and laboratory experiments in cycling temperatures. This raises the question of whether all the genetic and physiological flexibility observed is usable in further adaptation or whether reproductive capacity, for example, becomes limiting. (See also W75-11046)  
W78-07398

**AQUATIC USE PATTERN FOR DIQUAT FOR CONTROL OF EGERIA AND HYDRILLA.**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
For primary bibliographic entry see Field 5G.  
W78-07399

**EFFICACY AND RESIDUES OF DIQUAT APPLIED FOR CONTROL OF EGERIA AND HYDRILLA.**  
Agricultural Research Service, Fort Lauderdale, FL, Southern Region.  
For primary bibliographic entry see Field 5G.  
W78-07400

**DISTRIBUTION, GROWTH, AND PHOSPHORUS RELATIONSHIPS OF MYRIOPHYLLUM HETEROPHYLLUM MICHX. IN LAKE WINNIPESAUKEE, NEW HAMPSHIRE.**  
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.  
E. C. Penniman.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 034. Price codes: A12 in paper copy, A01 in microfiche. Master of Science Thesis, September 1977. 169 p. 69 fig., 18 tab., 60 ref. OWRT A-043-NH(1), 14-31-0001-5029.

Descriptors: \*Aquatic vascular plants, \*Aquatic plant control, \*Submerged plants, \*Phosphorus, \*Phosphates, Lake sediments, Water pollution sources, Aquatic habitats, Ecology, Plant growth, Substrates, Littoral, \*Myriophyllum heterophyllum Michx., Aquatic macrophytes, Algal epiphytes, Herbicides, \*Lake Winnepesaukee(NH), \*New Hampshire, Hodgdon herbarium.

Myriophyllum heterophyllum Michx. has been described as the dominant aquatic vascular plant in the littoral of Lake Winnepesaukee, N.H. Its distribution, throughout the lake, was mapped and its habitat preferences were noted. The plant is present in areas with a silt-sand substrate and low wave action at depths of 0.5 to 3 m. The density of the stands was determined at three sites. Rapid colonization and stand expansion occurred through vegetative reproduction. Tissue phosphorus levels of M. heterophyllum varied seasonally and reached a maximum of 0.75% dry weight during late May. A correlation between tissue phosphorus enrichment of the water produced a marked increase in tissue phosphorus of M. heterophyllum. Growth of the plants occurred from April through October with the maximum growth rate (June through August) at more than 1.5 cm/day. In batch culture tissue phosphorus levels of shoot apices are proportional to phosphorus levels in the medium. Luxury consumption (Gerloff, 1975) of phosphorus was evident. Two uptake mechanisms appeared to function in phosphorus uptake. In culture both uptake and growth were affected by temperature, while growth rate was not affected by the phosphorus concentration in the medium. Phosphorus was released from decaying plants.  
W78-07482

**SALT LOADING IN DISTURBED WATERSHED-FIELD STUDY.**  
Golder and Associates, Seattle, WA.  
For primary bibliographic entry see Field 5B.  
W78-07484

**MARINE WASTE DISPOSAL IN THE NEW YORK BIGHT—PUBLIC POLICY, ENVIRONMENTAL IMPACTS, AND ALTERNATIVE FUTURES.**  
National Association of Regional Councils, Washington, DC.  
For primary bibliographic entry see Field 5E.  
W78-07529

**THE RESULTS OF FOUR OCEANOGRAPHIC CRUISES IN THE GEORGIA BIGHT.**  
Skidaway Inst. of Oceanography, Savannah, GA.  
For primary bibliographic entry see Field 2L.  
W78-07537

**EVALUATION OF WATER QUALITY OF PUGET SOUND AND HOOD CANAL IN 1976.**  
National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.  
R. D. Cardwell, C. E. Woelke, M. I. Carr, and E. W. Sanborn.  
NOAA Technical Memorandum ERL MESA-21, June 1977. 41 p., 6 fig., 2 tab., 26 ref., 5 append.

Descriptors: \*Water quality, \*Mortality, \*Oysters, \*Water pollution, Dinoflagellates, Larvae, Washington, \*Puget Sound, \*Hood Canal, Flushing, Red tide, Crassostrea gigas, Ceratium fusus.

Marine water quality of the Puget Sound basin south of Whidbey Island and of Hood Canal was assessed on 20 July and 15 September 1976, respectively. Water quality was described toxicologically using Pacific oyster (*Crassostrea gigas*) larvae as an indicator and chemically using the following synoptic parameters: dissolved oxygen, pH, salinity, temperature, ammonia, Pearl-Benson Index-sensitive substances, and total organic carbon. The principal water quality problem of this area caused oyster larvae to die, usually within approximately 20 hours. Restricted mainly to waters from the heads of bay and inlets in the basin, larval mortality possibly may be linked etiologically to toxic metabolites of phytoplankton or bacteria or both. Densities of the armored dinoflagellate *Ceratium fusus* explained 72% of the variation in larval mortality for waters from three inlets where the relationship was examined. Total organic carbon explained only 22% of such variation. Commencement Bay was the principal area where larval development was affected. Larvae also developed abnormally in waters possessing salinities below those considered acceptable for their normal development. Locales possessing diminished water quality are usually embayments and similar areas possessing restricted flushing. (NOAA)  
W78-07544

**SOME PARASITES AND DISEASES OF ESTUARINE FISHES IN POLLUTED HABITATS OF MISSISSIPPI.**  
Gulf Coast Research Lab., Ocean Springs, MS.  
R. M. Overstreet, and H. D. Howse.  
Annals of the New York Academy of Sciences, Vol. 298, p. 427-462, September 29, 1977. 42 fig., 2 tab., 95 ref. PL 88-309, Proj. 2-262-R, SG-04-6-158-44060.

Descriptors: \*Estuaries, \*Parasites, \*Diseases, \*Water pollution effects, \*Mississippi, Habitats, Fishes, Shellfish, Pesticides, Heavy metals, Sewage, Domestic wastes, Neoplasms.

Several diseases that afflict both finfishes and shellfishes that live in waters suspected or known to be polluted are described. Pollutants can affect

animals directly by causing acute to chronic diseases or they can affect the animals indirectly by stressing them and thus allowing them to be vulnerable to parasites or other disease agents, forming synergistic or other-type relationships between the pollutant and other chemical or disease-causing agent, permitting predators to become affected by feeding on exposed animals, or destroying the environment so that the animals can no longer live, grow, or reproduce. Brief comments follow on the habitats and pollutants in Mississippi and examples of a variety of diseases and conditions that affect fishes in polluted habitats are given. (NOAA)  
W78-07546

**NUTRIENT DISTRIBUTIONS AND TRANSPORT IN LONG ISLAND SOUND.**  
State Univ. of New York at Stony Brook, Marine Sciences Research Center.  
For primary bibliographic entry see Field 5B.  
W78-07550

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME I. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER APRIL - JUNE 1977.**  
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.  
For primary bibliographic entry see Field 6G.  
W78-07558

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME II. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER APRIL - JUNE 1977.**  
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.  
For primary bibliographic entry see Field 6G.  
W78-07559

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME I, PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER JULY - SEPTEMBER 1977.**  
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.  
For primary bibliographic entry see Field 6G.  
W78-07560

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME II, PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER JULY - SEPTEMBER 1977.**  
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.  
For primary bibliographic entry see Field 6G.  
W78-07561

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME III, PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER JULY - SEPTEMBER 1977.**  
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.  
For primary bibliographic entry see Field 6G.  
W78-07562

**ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE. PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (EXECUTIVE SUMMARY).**  
Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07563



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART B: CALIFORNIA (EXECUTIVE SUMMARY),

Jones and Stokes Associates, Inc., Sacramento, CA.  
For primary bibliographic entry see Field 6G.  
W78-07564

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART B: CALIFORNIA (FINAL REPORT),

Jones and Stokes Associates, Inc., Sacramento, CA.  
For primary bibliographic entry see Field 6G.  
W78-07565

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART B: CALIFORNIA (CASE STUDIES),

Jones and Stokes Associates, Inc., Sacramento, CA.  
For primary bibliographic entry see Field 6G.  
W78-07566

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (FINAL REPORT),

Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07567

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (ROCKY MOUNTAIN REGION CASE STUDIES),

Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07568

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (PACIFIC NORTHWEST REGION CASE STUDIES),

Enviro Control, Inc., Rockville, MD.  
For primary bibliographic entry see Field 6G.  
W78-07569

#### MICROBIAL INTERACTIONS WITH PESTICIDES IN ESTUARINE SURFACE SLICKS,

Georgia State Univ., Atlanta. Dept. of Biology.  
D. G. Ahearn, S. A. Crow, and W. L. Crow.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 978.  
Price codes: A03 in paper copy, A01 in microfiche.  
Environmental Protection Agency, Ecological Research Series, Report EPA 600/3-77-050, April 1977. 22 p., 14 tab., 20 ref.

Descriptors: Sea water, \*Bacteria, Estuarine environment, \*Pesticides, \*Marine bacteria, Marine microorganisms, Surface waters, Florida, Methodology, Laboratory tests, Microbiology, \*Yeasts, \*Fungi, \*Polychlorinated biphenyls, \*Phenols, \*Heptachlor, Escambia Bay (Fla.), Membrane absorption technique, Estuarine surface films, O-chloro-naphthalene, PCB 1016, Pentachlorophenols, Biphenyl, Pyrene, Hexadecane utilization.

Estuarine surface films from Escambia Bay, Florida, and adjacent waters were sampled by using the membrane adsorption technique to enumerate microbial populations. Samples of the upper 10 micrograms of estuarine surface films yielded microbial populations up to 10 to the 8th

power ml-1 or 10 to the 5th power cm-2. These populations were 10-100 times greater than those in underlying water of 10 cm. Predominant bacteria in surface films as isolated on Marine Agar were motile, nonpigmented, gram-negative rods. Twenty-one representative bacteria, yeasts, and filamentous fungi from initial sampling of surface microlayers were tested for the effects of selected pesticides on utilization of various substrates. One bacterium was sensitive to PCB formulations. In subsequent studies with 53 isolates representative of more diverse physiological groups, o-chloro-naphthalene, PCB 1016, and pentachlorophenol were inhibitory to a large portion of the isolates and heptachlor, biphenyl, pyrene, and PCB 1016 significantly reduced hexadecane utilization. (Katz-EIS)  
W78-07605

#### SEWAGE FUNGUS GROWTH IN RIVERS RECEIVING PAPER MILL EFFLUENT,

Research Association for the Paper and Board Printing and Packaging Industries, Surrey (England).  
J. C. Roberts.  
Water Research, Vol. 11, p 603-610, 1977. 6 fig., 7 tab., 14 ref.

Descriptors: \*Pulp wastes, Pulp and paper industry, \*Organic wastes, \*Carbohydrates, \*Fungi, \*Aquatic fungi, \*Sewage effluents, \*Waste water disposal, \*Sphaerotilus, \*Liquid wastes, \*Nutrients, \*Cellulose, Water pollution sources, Industrial wastes, \*Starches.

A study has been made of the chemical composition of a paper mill effluent which is known to cause severe growths of sewage fungus in the river into which it is discharged. Carbohydrate proved to be the major soluble organic component and was investigated in detail, so that the raw materials and mill processes which were responsible for its presence could be determined. An investigation into the amount and type of carbohydrate which was extracted during the aqueous disintegration of waste paper and chemically produced wood pulp (the two major raw materials) revealed that the former made the greater contribution to the dissolved carbohydrate which was present in the effluent. (Deal-EIS)  
W78-07655

#### CHLORINATED HYDROCARBONS IN MACROINVERTEBRATES AND FISH FROM THE LOWER MEDWAY ESTUARY, KENT,

John Cass Coll., London (England).  
J. R. Wharfe, and W. L. F. Van Den Broek.  
Marine Pollution Bulletin, Vol. 9, No. 3, p 76-79, 1978. 1 fig., 3 tab., 22 ref.

Descriptors: \*Chlorinated hydrocarbon pesticides, \*Aldrin, \*Aroclors, \*DDE, \*DDT, \*Dieldrin, \*Endrin, \*Heptachlor, \*Polychlorinated biphenyls, \*Pesticide residues, \*Pollutant identification, Invertebrates, Mussels, Crabs, Shrimp, Fish, Gas chromatography, Water pollution sources, Path of pollutants, Tissue analysis, Bioaccumulation, \*Lower Medway Estuary, England.

Macroinvertebrates and fish collected periodically from April 1973 to January 1976, from the Lower Medway Estuary, Kent, were analysed for a range of heavy metals, organochlorine, pesticides and polychlorinated biphenyls. The heavy metal studies have been previously documented. Analysis of mussels, shore crabs, periwinkles, ragworms, shrimps, and selected fish tissues for chlorinated hydrocarbons showed quantifiable amounts of DDT and its metabolites, dieldrin and PCBs. Low, non-quantifiable levels of aldrin, endrin, and alpha- and gamma-BHC were also detected. (Deal-EIS)  
W78-07661

#### EFFECT OF CHEMICAL SPECIATION ON TOXICITY OF CADMIUM TO GRASS SHRIMP, PALAEMONETES PUGIO: IMPORTANCE OF FREE CADMIUM ION,

National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.  
W. G. Sunda, D. W. Engel, and R. M. Thuoette.  
Environmental Science and Technology, Vol. 12, No. 4, p 409-413, 1978. 5 fig., 2 tab., 19 ref.

Descriptors: \*Toxicity, \*Mortality, \*Cadmium, \*Salinity, \*Nitrilotriacetic acid, \*Chelation, \*Shrimp, \*Chlorides, Ions, Chemical reactions, Metals, Sea water, Copper, Bioassay, Brackish water, \*Palaemonetes, \*Chemical speciation, Complexation.

Experiments were carried out in diluted seawater media at different salinities (4-29‰) and different concentrations of the chelator NTA (nitrilotriacetic acid) to determine the relationship between the chemical speciation of cadmium and the toxicity of cadmium to grass shrimp. After four days of exposure to a given concentration of CdCl<sub>2</sub>, shrimp mortality decreased with increasing salinity and increasing concentration of NTA. The protective effect of high salinity or NTA was attributable to the complexation of cadmium. Mortality was related to the measure free cadmium ion concentration that, in turn, was determined by the total concentration of cadmium and by the level of complexation by either chloride ion or NTA. Fifty percent mortality occurred at a free cadmium ion concentration of about 4 x 10 to the 7th power M. (Deal-EIS)  
W78-07662

#### TRACE METAL-CHELATOR INTERACTIONS AND PHYTOPLANKTON GROWTH IN SEAWATER MEDIA: THEORETICAL ANALYSIS AND COMPARISON WITH REPORTED OBSERVATIONS,

California Inst. of Tech., Pasadena. W. M. Keck Lab. of Environmental Science.  
G. A. Jackson, and J. J. Morgan.  
Limnology and Oceanography, Vol. 23, No. 2, p 268-282, 1978. 4 fig., 9 tab., 33 ref.

Descriptors: \*Chelation, \*Phytoplankton, \*Growth rates, \*Marine algae, \*Ions, \*Copper, \*Biological membranes, \*Membrane processes, \*Toxicity, \*Chemical reactions, \*Equilibrium, \*Diatoms, \*Iron, \*Zinc, Metals, Sea water, Bioassay, \*Ligands, Chaetoceros socialis.

Effects of trace metal chelators in seawater are examined theoretically in terms of equilibrium chemical speciation in seawater; of chemical interactions between all metals, naturally occurring ligands, and added organic chelating agents of various binding strengths and total concentrations; and of transfer of trace metals to the phytoplankton cell surface. An equilibrium model involving 18 metals and 8 ligands is applied to find the metal species in natural seawater, chelator-amended seawater, and synthetic seawater media. Three mechanisms for enhanced supply of iron via chelation are examined: transport through the membrane, ligand exchange at the cell surface, and increased supply of iron to the cell surface by dissociation of a chelate. None account for the observed effects of chelator variations in growth rate. Detoxification of toxic metals via chelation shows a strong correlation between growth rate and free Cu<sup>2+</sup> computed at equilibrium in solution. (Deal-EIS)  
W78-07663

#### COPPER SENSITIVITY OF GONYAULAX TAMARENSIS,

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.  
D. M. Anderson, and F. M. M. Morel.  
Limnology and Oceanography, Vol. 23, No. 2, p 283-295, 1978. 6 fig., 6 tab., 36 ref.

Descriptors: \*Copper, \*Ions, \*Biological membranes, \*Ion exchange, \*Chelation, \*Nitrotriacetic acid, \*Dinoflagellates, \*Toxicity, \*Photosynthesis, \*Growth rates, \*Movement, Chemical reactions, Aquatic microorganisms, Algae, Metals, Gonyaulax, Complexation.

The copper sensitivity of the dinoflagellate *Gonyaulax tamarens* was examined in artificial seawater medium. Two short term responses of the organism to copper toxicity are rapid loss of motility and reduced photosynthetic carbon fixation. The chelators tris (hydroxymethylamino)methane (Tris) and ethylenedinitrilotetraacetic acid (EDTA) were used to demonstrate that copper toxicity is a unique function of cupric ion activity. *G. tamarens* growth is totally inhibited at cupric ion activities that only partially inhibit the growth of four other species that have been studied extensively. Furthermore, this toxicity occurs at the calculated copper activity of natural waters, assuming only inorganic copper complexation. Thus organic chelation may be necessary before *G. tamarens* can successfully compete with other algal species in coastal waters. (Deal-EIS)  
W78-07664

**A PRELIMINARY STUDY OF THE USE OF BENTHIC ALGAE AS BIOLOGICAL INDICATORS OF HEAVY METAL POLLUTION IN SORFJORDEN, NORWAY.**  
Central Inst. for Industrial Research Oslo (Norway).  
For primary bibliographic entry see Field 5A.  
W78-07665

**A FIVE-YEAR MONITORING STUDY OF THE CHLORINATED HYDROCARBONS IN THE FISH OF A FINNISH LAKE ECOSYSTEM.**  
Jyväskylä Univ. (Finland).  
For primary bibliographic entry see Field 5A.  
W78-07667

**A COMPARATIVE STUDY OF THE EFFECTS OF MERCURIC CHLORIDE AND METHYL MERCURY CHLORIDE ON REPRODUCTIVE PERFORMANCE IN THE BRINE SHRIMP, ARTEMIA SALINA.**  
North Carolina State Univ. at Raleigh. Dept. of Genetics.  
P. A. Cunningham, and D. S. Grosch.  
Environmental Pollution, Vol. 15, p 83-99, 1978. 4 fig, 6 tab, 34 ref.

Descriptors: \*Shrimp, \*Mercury, \*Animal metabolism, Animal physiology, \*Brine shrimp, \*Reproduction, Animal behavior, \*Toxicity, Mortality, \*Growth stages, \*Fecundity, \*Fertility, Metals, Water pollution effects, Chlorides, Bioassay, \*Methylmercury, Artemia, Nauplii.

Effects of mercuric chloride (MC) and methyl mercury chloride (MMC) on reproduction in brine shrimp were investigated using pair-mating experiment. Reproductive performance of pairs exposed to 0.0001, 0.005 and 0.01 ppm MC and 0.001, 0.002, 0.005, and 0.01 ppm MMC was compared. Significant reduction in adult lifespan occurred at 0.01 ppm MC, and 0.005 and 0.01 ppm MMC. The survival of nauplii produced by treated parents was not reduced at any MC exposure, but significant reduction resulted at 0.001 and 0.002 ppm MMC. Pairs exposed to greater than 0.002 ppm MMC did not produce nauplii. Cysts produced by MC and MMC treated pairs displayed 50% less viability than controls. MMC was more toxic to adult Artemia than MC, affecting both production and survivorship of offspring. (Deal-EIS)  
W78-07668

**PATTERNS OF SUCCESSION IN BENTHIC INFAUNAL COMMUNITIES FOLLOWING**

**DREDGING AND DREDGED MATERIAL DISPOSAL IN MONTEREY BAY.**  
Moss Landing Marine Lab. CA.  
J. S. Oliver, P. N. Slattery, L. W. Hulberg, and J. W. Nybakken.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A049 632. Price codes: A09 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-27, October 1977. 186 p, 15 tab, 94 fig, 55 ref, 1 append.

Descriptors: \*Benthic fauna, \*Dredging, \*Succession, Environmental effects, Crustaceans, California, \*Dredged material disposal, \*Monterey Bay (Calif.).

Patterns of benthic succession in soft-bottom marine communities are presented. The primary study objective was to elucidate and evaluate the mechanisms that control these patterns. Benthic succession is the pattern of community recovery following a perturbation. Controlled perturbations of bottom communities were effected by the dredging of locations in Moss Landing Harbor and by the disposal of dredged material in Monterey Bay, California. A positive relationship was determined between community resilience (rate of recovery or succession) and environmental and community variability. Communities inhabiting highly variable and disruptive environments (e.g., shallow water in offshore areas and the back harbor) rebounded or recovered more quickly from the experimental disturbances (dredging and disposal) than those found in less variable and more benign conditions (e.g., deeper water offshore and outer harbor areas bathed by more marine water). Community resilience was correspondingly lower in the more complex communities of deeper water. It was concluded that the management of benthic marine resources and dredging operations should involve an analysis of the natural disturbance regime at a potential dredging or disposal site and its relation to the associated bottom communities. (WES)  
W78-07677

**FACTORS INVOLVED IN THE RESISTANCE OF BROOK TROUT TO SULFURIC ACID SOLUTIONS AND MINE ACID POLLUTED WATERS.**  
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.  
F. A. Swarts.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 102. Price codes: A08 in paper copy, A01 in microfiche. Master of Science thesis, The Pennsylvania State University, University Park. Dept. of Biology, November, 1977. 141 p, 21 tab, 4 fig, 49 ref, OWRT A-042-PA(3), 14-34-0001-6039.

Descriptors: \*Brook trout, \*Acid mine water, Juvenile trout, \*Hydrogen ion concentration, Mine drainage, Water pollution effects, \*Wild brook trout, Hereditary resistance, Mine acid waters, Sodium loss, Hatchery fish, Sulfuric acid solution, Adult trout, Survival ability.

Several strains of hatchery-reared brook trout were exposed to low pH's in laboratory and field tests. Wild brook trout were used in some field tests. Tests were both acute and chronic. Pronounced strain differences in survival ability were detected among embryonic, juvenile, and adult brook trout in laboratory tests, and among juvenile trout in field tests. Fish had longer resistance times in sulfuric acid solutions, and in mine acid polluted water, if they were held previously in, respectively, control laboratory water, or non-acidic field environments. Wild brook trout survived longer at lethal field pH's than hatchery fish. Fish had shorter resistance times in field tests in mine acid waters than in laboratory tests with sulfuric acid solutions of comparable pH. Larger and older fish tended to survive longer. There

were no differences between the sexes in survival times at low pH's. The most important factors in enhancement of acid resistance in hatchery brook trout were the hereditary resistance of a given strain and the acclimation of fish to stream of laboratory conditions of control pH prior to acid exposure. The establishment of strains superior in acid survival ability will probably require many generations of selection. (Sink-Penn State)  
W78-07684

## 5D. Waste Treatment Processes

**PERFORMANCE OF A TRICKLING FILTER, SOLIDS REMOVAL, AND ANAEROBIC DIGESTION SYSTEM FOR RECYCLED POULTRY MANURE WASTEWATER.**  
Auburn Univ., AL. Dept. of Agricultural Engineering.  
H. E. Hamilton.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 576. Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Auburn University, Bulletin 31, September, 1977. 34 p, 17 fig, 2 tab, 22 ref. OWRT A-049-ALA(1).

Descriptors: \*Poultry manure wastewater, \*Recycling, Volatile solids loading rates, Hydraulic recirculation, \*Trickling filters, Filtration, \*Anaerobic digestion, \*Farm wastes, \*Performance, Lagoons, \*Waste water treatment.

A laboratory system was designed, constructed, and evaluated to explore the possibilities for recycling poultry manure wastewater. The system tested three volatile solids loading rates (1.076, 2.152, and 4.304 kg/m<sup>2</sup>/day) in combination with three hydraulic recirculation rates (0.5, 1.0, and 2.0 L/m<sup>2</sup>/sec). An initial solids removal of about 9%, dry basis from the raw manure-sludge mixture was accomplished by the vibrating screen separator. This amounted to about 8.6% of the volatile solids at the daily loading rate of 2.152 kg/m<sup>2</sup>/day. Test results indicate that the highest recirculation rate in combination with volatile solids loading rates up to 2 kg/m<sup>2</sup>/day would provide an acceptable flush-water for removing manure from caged layer and broiler houses. The study has shown a definite potential for prototype facilities which would replace large lagoons and eliminate overflow problems.  
W78-07207

**STATE VARIABLE MODEL FOR SEWER NETWORK FLOW ROUTING.**  
Texas Univ. at Austin. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 8B.  
W78-07212

**NITRIFICATION AND NITROGEN REMOVAL.**  
Corning Glass Works, NY.  
B. Sharma, and R. C. Ahlert.  
Water Research, Vol. 11, No. 10, p 897-925, 1977. 12 fig, 7 tab, 223 ref. OWRT A-030-NJ(6).

Descriptors: \*Nitrification, \*Ammonia, \*Mathematical models, \*Nutrient removal, \*Kinetics, \*Reviews, Nitrites, Nitrogen compounds, Chemical reactions, Microorganisms, Denitrification, Waste water treatment, \*Bibliographies.

Various aspects of the use of nitrifying bacteria and nitrification processes in the aerobic biological treatment of waste water are discussed. The biochemistry of nitrification and characteristics of nitrifying bacteria are described. Recent literature on the effects of dissolved oxygen, temperature, pH, ammonia and nitrite ion concentrations, and the concentration of nitrifiers on nitrification processes is reviewed. The effects of sludge age, organic loading, detention time, surfaces, turbulence, light, micronutrients, organic matter, and

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

microbial interactions are also considered. Mathematical models for nitrification and nitrifier growth kinetics are discussed with respect to the determination of kinetic constants, modelling of nitrifiers in attached growth and in streams, and the dynamic behavior of nitrifying systems. Single and combined stage processes for the removal of carbon, ammonia, and nitrogen from waste water are detailed. (Schulz-FIRL)  
W78-07215

**MAKE WASTEWATER MORE VERSATILE: REUSE IT FOR RECREATION LAKES.**  
Oklahoma State Univ., Stillwater. Dept. of Civil Engineering.  
M. Headstream, D. M. Wells, R. M. Sweazy, and R. C. Baskett.

Water and Wastes Engineering, Vol. 14, No. 9, p 144-145, 147, 149-150, September 1977. 7 fig. OWRT C-6053(5205)(3).

Descriptors: \*Water reuse, \*Waste water disposal, \*Lakes, \*Algal control, \*Municipal wastes, \*Makeup water, Recreation facilities, Limiting factors, Phosphorus, Lubbock (TX), Texas, Water shortage, Percolating water, Model studies, Fish, Eutrophication, Nutrients, Biocontrol, Chemcontrol, Diuron, Algae, Tilapia, Channel catfish, Copper sulfate.

Tests show that reuse of percolated wastewater as makeup water for recreational lakes is feasible if a program of algal control is also added. Reclaimed water proved generally suitable for sustaining channel catfish and bass, but very objectionable blooms of chlorophyte algae resulted. Biological control attempts with the algae-eating fish Tilapia were unsuccessful, as were chemical control efforts with copper sulfate and a 1:1 mixture of copper sulfate and sodium citrate. Satisfactory control was achieved with the algicide Diuron. Laboratory tests showed that phosphorus concentrations at 0.005 mg/l were limiting, a level too low for possible application feasibility. Tests of eight experimental systems demonstrated that bacteria was unable to compete successfully for available phosphorus in the presence of competition; the algal population (*Chlorella vulgaris*) could assimilate or store more than half the available phosphorus in the first day of the experimental period, even in the presence of competition. Algal utilization was ultimately limited by sediment uptake and not by bacteria incorporation. Results of these studies will be used by the city of Lubbock, Texas in reusing municipal wastewater in four small recreational lakes. Three fishkills in the experiments were caused by factors unrelated to the recycled wastewater. (Lynch-Wisconsin)  
W78-07217

**REMOVAL OF CHROMIUM, CHROMATE, MOLYBDATE AND ZINC.**  
Chemical Separations Corp, Oak Ridge, TN. (Assignee).  
R. C. Chopra.  
U.S. Patent No. 4,057,494, 10 p, 1 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 964, No 2, p 568-569, November 8, 1977.

Descriptors: \*Patents, \*Cooling water, \*Separation technique, Industrial wastes, Metals, Zinc, Chromium, Ion exchange, Resins, Chemical reactions, Waste water treatment.

The continuous evaporation of fluid circulating through a cooling tower will precipitate increasing concentrations of dissolved solids in the unevaporated fluid. Eventually, as the fluid is continuously recycled back to the cooling tower, the concentration of the dissolved solids will become so high that the fluid will no longer be able to function as a coolant. Since only water can evaporate and none of the dissolved solids which are present in it can evaporate, the concentration of the dissolved solids will increase. The solids which are objectionable and which must be removed include

trivalent chromium, hexavalent chromate, molybdate and bivalent zinc. Trivalent chromium, zinc, hexavalent chromate and molybdate can be removed from a fluid by contacting the fluid with an ion exchange resin bed comprising a mixture of a weak base anion exchange resin and a weak or strong acid cation exchange resin in hydrogen form to remove the metal values. (Sinha-OEIS)  
W78-07231

**FLOW MONITORING APPARATUS.**  
Pro-Tech, Inc., Paoli, PA. (Assignee).  
K. W. Martig, Jr.  
U.S. Patent No. 4,058,011, 5 p, 3 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 3, p 739, November 15, 1977.

Descriptors: \*Patents, \*Monitoring, \*Measurement, \*Flow, Channel flow, Flow measurement, Sewers, Equipment.

For reasons of efficiency, as well as best usage of treatment facilities, it is imperative that the system for handling raw sewage handle nothing more than raw sewage. Those systems which handle raw sewage must be monitored to predict any unpredicted increase in demand due to storm inflow or ground water infiltration. This invention provides a method and portable apparatus for continually monitoring the flow of fluid in an open channel such as in a conduit having a known diameter, a known slope and of material having known surface characteristics. The liquid depth within the pipe is determined by means of an elongated hollow probe placed axially in the bottom of a channel containing the liquid and forcing gas under pressure through it. The measurement of the back pressure represents the depth of the liquid and enables the rapid determination of the rate of flow. It is contemplated that the portable apparatus be interconnected with a portable continual recorder such that the flow may be monitored over any given, desired time period. (Sinha-OEIS)  
W78-07236

**REMOVAL OF COLOR FROM PAPER MILL WASTE WATERS.**  
Nalco Chemical Co., Oak Brook, IL. (Assignee).  
J. J. Svarz.  
U.S. Patent No. 4,058,458, 5 p, 8 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 3, p 898, November 15, 1977.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Water quality control, \*Color removal, Separation techniques, Pulp and paper industry, Filtration, Chemical reactions, Chemical precipitation.

Color bodies can be removed from paper mill waste waters by adding to such waste waters under acidic conditions, preferably at a pH within the range of about 2 to about 5, a relatively small amount of an alkylated or acylated amine (or amide), or mixtures containing at least four carbon atoms in a hydrocarbon group linked to nitrogen. The amount used is sufficient to form a complex with the color bodies which is insoluble in and can be separated from the waste waters by settling or filtration. The compounds employed for the purpose of the invention can be used in amounts as low as 20 ppm with respect to the waste water or bleachery effluent and, in most cases, will not exceed 2,000 ppm, depending upon the particular compound employed. (Sinha-OEIS)  
W78-07238

**ELEMENT FOR FILTERING AND SEPARATING FLUID MIXTURES.**  
Keene Corp., NY. (Assignee).  
I. Bartik.  
U.S. Patent No. 4,058,463, 7 p, 6 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 964, No 3, p 899-900, November 15, 1977.

Descriptors: \*Patents, \*Waste water treatment, Water pollution treatment, Oil pollution, Only water, Industrial wastes, \*Filtration, \*Filters, \*Separation techniques.

Industrial discharge waters are treated to remove oil, fuels or other liquids from the water so that the water is sufficiently clean to be discharged into sewers or other collection systems. The contamination fluid mixture is passed through one or element provides for filtration of the fluid and also for coalescing of the admixed fluids in individual droplets of substantial size. The element is substantially cylindrical and receives fluids to be treated on the inside for radially outward flow through the element. The element has an inner layer is mechanically supported on the outside and surrounding the support for the inner layer is a coalescing media which causes the oil and water to separate. The oil separated from the water will raise by difference in specific gravity to the upper portion of the pressure vessel where it can be drawn off, while the water sinks toward the bottom of the vessel and is discharged from the lower portion. (Sinha - OEIS)  
W78-07240

**METHOD FOR CLARIFYING WASTE WATER CONTAINING FINELY DIVIDED OILY MATERIALS.**  
Mitsubishi Rayon Co., Ltd., Tokyo (Japan). (Assignee).  
M. Musha, T. Sawa, and O. Kato.  
U.S. Patent No. 4,059,511, 10 p, 1 fig, 4 tab, 5 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1259, November 22, 1977.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Oily water, Separation techniques, Suspended solids, Fibrous beds, \*Filtration, Hydrophilic fibers.

Waste water containing finely divided oily materials and solid materials suspended can be clarified by forwarding the waste water successively through fibrous strata which are arranged along a path of the waste water. Each of the strata is composed of a mass of hydrophilic organic polymer fibers compressed in such a manner that the closer the location of the fibrous stratum is to the supply source of the waste water, the greater the gaps on the average are formed between the fibers in the stratum. This allows the particles of the finely divided oily materials to coarsen and to catch and collect finely divided solid materials into the coarsened particles. Then the waste water is introduced into a space in which the coarsened particles are allowed to float and form a separate layer of the oily materials containing the solid materials on the upper surface of the waste water. The oily materials are discharged and clarified water is delivered. (Sinha-OEIS)  
W78-07245

**METHOD FOR PURIFICATION OF INDUSTRIAL WASTE WATER.**  
Elkem-Spigerverket A/S, Oslo (Norway). (Assignee).  
K. W. Jahnsen.  
U.S. Patent No. 4,059,514, 4 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1260, November 22, 1977.

Descriptors: \*Waste water treatment, Water pollution treatment, \*Industrial wastes, Water purification, \*Oxidation, \*Flocculation, Separation techniques, Equipment, \*Cyanides, Metal working industry.

The invention relates to a method for purification of industrial waste water, and especially to the removal of cyanides from waste water from metallurgical and metal-working industrial plants. It has now been discovered that the oxidation or decomposition of the cyanides and the mechanical flocculation can be combined in one single step. The



## Waste Treatment Processes—Group 5D

required amounts of sodium hypochlorite or gaseous chlorine for oxidation of the cyanides along with alkali for raising the pH to that level which will give optimum reaction conditions are added to the waste water in conventional amounts and manner and then the water is conducted to a combined prereaction and flocculation container in which the mechanical flocculation and oxidation of cyanides takes place simultaneously. The pre-reaction and flocculation container is provided with an inner and an outer compartment. The waste water is fed into the inner compartment where it flows through the compartment and into the outer compartment where it flows countercurrently to the direction of flow in the first compartment. Conventional agitation means are provided in the inner compartment. From this container the water is led to a combined after-reaction and sedimentation container. Best results are achieved by thoroughly mixing the reagents in the waste water before it enters the prereaction and flocculation chamber. (Sinha-OEIS)  
W78-07247

## PROCESS FOR CLARIFICATION OF OIL-CONTAINING WASTE.

Betz Lab., Inc., Trevose, PA. (Assignee).  
W. J. Fowler, R. A. Heberle, R. G. Tonkyn, and N. Vorchheimer.  
U.S. Patent No. 4,059,515, 6 p, 3 tab, 5 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1260, November 22, 1977.

Descriptors: \*Patents, \*Waste water treatment, \*Oil water, \*Oil pollution, \*Water pollution treatment, \*Separation techniques, Industrial wastes, Polymers, Flocculation.

An object of the invention is to provide a water-soluble cationic polymeric material useable in separating oil from industrial oily wastes, which would overcome the drawbacks of the acid-alum process. It was discovered that the separation of oil from oil-containing wastes could be effectively achieved by utilizing a water-soluble cationic polymer obtained by the polymerization of an epthalohydrin with a specific family of alkylene polyamine. The addition of alum can be drastically reduced or eliminated by using this water-soluble cationic polymeric material. If a combined alum-polymer treatment is utilized, the pH of the wastewater should be properly adjusted to ensure that the alum will remain insoluble to act as a coagulant aid. If the polymer is used in the absence of alum, the activity of the polymer in separating the oil from the water has been found to be relatively independent of pH. (Sinha-OEIS)  
W78-07248

## PROCESS FOR TREATING WOOL SCOURING WASTES.

Bollman (George W.) and Co., Inc., Adamstown, PA. (Assignee).  
W. A. Heisey.  
U.S. Patent No. 4,059,516, 5 p, 1 fig, 1 tab, 6 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1260-1261, November 22, 1977.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, \*Industrial wastes, Textiles, Separation techniques, Bentonite, Wool scouring, Wool grease recovery.

Raw wool is first scoured using conventional techniques to remove the wool grease, suint, earthy materials and any other impurities that may be present by use of detergents. The scouring process takes place in tanks or bowls at an elevated temperature, usually in the range of 130 to 150 deg. F. The heated spent waste liquor is drawn off in a generally continuous manner and passed through a heat exchanging device to cool the liquor from the scouring temperature to a temperature in the range of 80 to 100 deg. F. While it is known that acid cracking processes will produce

an effluent which has a COD level which is more acceptable for disposal compared to a straight mechanical process, the acid cracking process waste is still inadequately purified, because of the remaining high organic content and high acidity. An accepted method to better purify the acid cracked waste liquor includes the addition of dispersible-type bentonite in conjunction with the acid cracking. Then the flocculated liquor is reheated to a temperature in the range of 130 to 150 deg. F. to separate the waste liquor into a supernatant liquor and a settled drainable sludge and finally dewatering the settled sludge by centrifugal separation. (Sinha-OEIS)  
W78-07249

## SEWAGE PURIFICATION SYSTEM.

R. W. Lumsden.  
U.S. Patent No. 4,059,521, 9 p, 9 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1263, November 22, 1977.

Descriptors: \*Patents, \*Waste water treatment, \*Sewage treatment, \*Water pollution treatment, \*Biological treatment, Microorganisms, Mixing, Filtration, Equipment, Soil disposal fields.

A sewage purification system for purifying liquid sewage containing biologically degradable solid waste material is described. The sewage is subjected to successive treatment steps in three basic consecutive stages during which the sewage is agitated to break up the solid waste material and encourage the proliferation of microorganisms for the digestion of the waste material, settled to effect separation of the purified liquid component from the residual solid waste material in suspension. The latter is recycled back to the first stage for re-treatment and the purified liquid is passed to a third elongate tank having perforations in its wall section for distributing the liquid into the ground. The entire system in buried below ground level except for at least one access manhole extending above ground level for inspection and servicing purposes. (Sinha-OEIS)  
W78-07250

## WATER PURIFYING DEVICE WITHOUT MOVABLE MECHANICAL PART IN CONTACT WITH THE LIQUID TO BE TREATED.

J. Chataigner, and J. J. Rader.  
U.S. Patent No. 4,059,524, 6 p, 2 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1264, November 22, 1977.

Descriptors: \*Patents, \*Waste water treatment, \*Domestic wastes, \*Water pollution treatment, Sewage treatment, Septic tanks, Water purification, \*Biological treatment, Equipment, \*Oxidation, Decanting.

A tank is comprised of a single chamber which is alternatively used as an oxidation chamber and as a decanting chamber. The tank is progressively filled up with domestic wastes without liquid outflow, and afterwards, after a periodically running period of treatment, whatever be the liquid level in the tank, the clarified water is discharged while keeping the necessary amount of biological muds. The method for treating the water includes the following steps: to feed the tank with used water without withdrawing the yet clarified water; to oxidize and periodically make homogeneous the products in the tank; to let the product decant in the tank during a long period of time sufficient for the separation of clarified water and biological muds; and to discharge the clarified water after each prolonged decanting. (Sinha-OEIS)  
W78-07252

## PRETREATMENT FILTER PRESS DEWATERING SYSTEM.

A. Bahr.  
U.S. Patent No. 4,059,527, 18 p, 11 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1265, November 1977.

Descriptors: \*Patents, \*Waste water treatment, \*Sewage treatment, \*Water pollution treatment, Separation techniques, Sludge, Sludge treatment, Filters, \*Dewatering, Equipment, \*Filter presses.

An improved water removal in a filter press used in sludge treatment processes, typically in a sewage plant, is provided through the addition of a pretreatment stage where water is removed to an appreciable extent. The filter press pretreatment system is based upon continuously circulating filter pockets into which flocculant-treated sludge has been added, a significant amount of the water from the thus clarified sludge being removed through the combination of the use of this pretreatment and in this pretreatment using filter pockets of variable volume. (Sinha-OEIS)  
W78-07254

## BIOLOGICALLY PURIFYING WASTE WATER IN AIR TANK—USING EXTRACT OF EXCESS ACTIVE SLIME AS BIOTIMULATOR.

Soviet Patent SU546-568. Issued March 3, 1977. Derwent Soviet Inventions Illustrated, Vol. A, No. 1, p 1-2, February, 1978.

Descriptors: Pulp and paper industry, \*Sulfite liquors, \*Pulp wastes, \*Cellulose, \*Patents, Slime, \*Biological treatment, Aeration, Oxidation, Ammonium compounds, Phosphorus compounds, Industrial wastes.

A patent has been issued for a biological treatment process using active slime as a biostimulator in the treatment of sulfite and sulfate-cellulose waste waters from the pulping industry. Waste water bearing 250-500 mg active slime/liter is neutralized with sulfuric acid to pH 7 in an aeration chamber. Nutrient salts are added to the waste water to give a BOD:(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>:Na<sub>3</sub>PO<sub>4</sub> ratio of 100:3:1. The waste water mixture is aerated with oxygen for 6-8 hrs; the active slime content of 2-3 g/liter is then settled out over a 2 hr period. Excess slime is extracted from the clarified water and steam heated for 15 min before settling. The activated clarified liquor is added to waste water at a dose of 4-5 ml/liter to accelerate the biological purification process. One liter of the waste water mixed with the slime extract contains: 0.1-0.12 mg/liter thiamine, 0.09-0.5 mg riboflavin, 0.72-0.75 pyridoxine, 1.05-1.26 niacinamide, 0.01-0.02 biotine, 0.12-0.14 folic acid, 0.02-0.03 p-aminobenzoic acid, 0.43-0.44 pantothenic acid, 3.85-3.89 metaniosinole, 0.21-0.22 chlorine, and 0.75-1.5 vitamin B 12. The BOD of sulfite-bearing waste water with an initial content of 550 mg/liter was reduced by 86.4% with 2.5 mg slime/liter and 6 hrs contact time. A BOD concentration of 560 mg/liter in sulfate-cellulose effluent was reduced by 92.9% after 6 hrs. (Lisk-FRL)  
W78-07255

## REMOVAL OF CHROMIUM ANIONS FROM INDUSTRIAL EFFLUENTS—BY CONTACTING WITH PARTICLES OF INSOLUBLE LEAD CPD ADSORBED ON PARTICULATE INSOLUBLE CARRIER.

German Patent DS2361-167. Issued February 9, 1978. Derwent German Patents Abstracts, Vol. A, No. 7, p 3, March, 1978.

Descriptors: \*Adsorption, \*Ion exchange, \*Lead, \*Chromium, \*Metals, Cation exchange, Demineralization, Separation techniques, Anion exchange, Waste water treatment, Industrial wastes.

A patent has been issued for a process to remove chromium anions from plating waste water with an insoluble lead compound supported on vermiculite. The waste water is passed through a column equipped with a series of plates which support the insoluble vermiculite. Lead dioxide, lead carbonate, or lead hydroxide are preferred as the insoluble lead compounds used in the column. The lead to vermiculite ratio employed in the column is

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

1:1-4 by weight; the particle size of the vermiculite is preferably the range of 0.79-1.58 mm. The specific gravity of the lead compound-vermiculite mixture should be approximately 1.0. After the chromium-bearing waste water is passed through the column, it undergoes cation exchange to remove dissolved lead ions. Chromate levels are reduced by this process to a few parts per million. Regeneration is required less frequently than is necessary with other ion exchange columns. (Lisk-FIRL)

W78-07256

**BIOLOGICAL PURIFICATION OF SUGAR WORKS WASTE WATER—INCLUDES NEUTRALIZATION WITH LIME AND INOCULATION WITH CHLORELLA CULTURE USING LIGHT AND CARBON DIOXIDE.** Soviet Patent SU554-214. Issued May 12, 1977. Derwent Soviet Inventions Illustrated, Vol. A, No. 2, p 4, February, 1978.

Descriptors: \*Food processing industry, \*Sugar crops, \*Lime, \*Chlorella, \*Light, Ambient light, Ozone, Photosynthesis, Neutralization, Carbon dioxide, Algae, Waste water treatment, Industrial wastes.

A patent has been issued for a biological treatment process to purify sugar processing waste water using lime neutralization, Chlorella inoculation, light, and carbon dioxide. Suspended solids were first removed; the waste water was then neutralized with lime to pH 7.0-7.5. Carbon dioxide from flue gas was introduced into the waste water at 36-38 °C in an amount representing 3-12% of the volume of the algae. The waste water was illuminated during carbon dioxide treatment by 10-20 thousand lux and inoculated with an algal protococci culture. Suspended Chlorella were cultivated in the waste water until the desired algal volume was attained. The algae were removed from the waste water after one day and treated with ozone. The purified effluent was recycled to the sugar processing operations. The time required for treatment was reduced from 30-40 days to 1 day; water loss due to filtration and evaporation was prevented. Water intakes from potable sources were reduced; filtration beds and contamination by decomposing materials were eliminated by the Chlorella inoculation treatment. (Lisk-FIRL)

W78-07259

**HYGIENIC EVALUATION OF EFFECTIVENESS OF URBAN SEWAGE PURIFICATION IN OXIDATION PONDS (IN RUSSIAN).** Kiev Research Inst. of General Communal Hygiene (USSR).

Ya. K. Iostovetskii, G. V. Tolstopiatova, I. G. Chudova, L. F. Erusalimskaya, and O. V. Didenki. Gig Sanit 1, p 81-85, 1977.

Descriptors: Public health, \*Sewage treatment, \*Oxidation ponds, Municipal wastes, Waste water treatment, Bioindicators, Heavy metals, Organic compounds, \*Coli-index, Enterococcus, Microbes, USSR, Viruses.

Ten urban areas of the Ukrainian SSR (USSR) having large complex purification facilities with oxidation ponds were examined. Ponds were 0.7-1.5 m deep and water remained in them for 2-8 days. Final purification of water in oxidation ponds facilitated decreases in concentrations of suspended materials, organic compounds and salts of heavy metals. Water quality in terms of the coli-index, enterococcus count, and microbial number was especially improved during the summer months. Ponds were not always effective against intestinal viruses.—Copyright 1978, Biological Abstracts, Inc.

W78-07270

**BACKGROUND ECOLOGY AND THE EFFECTS OF NUTRIENT ADDITIONS ON A CENTRAL MICHIGAN WETLAND.**

Michigan Univ., Ann Arbor, School of Natural Resources.

For primary bibliographic entry see Field 5C.

W78-07279

**THE EFFECT OF CHEMICALS ON SOME MICROBIAL SELF-PURIFICATION PROCESSES IN BODIES OF WATER (IN RUSSIAN).**

Moskovskii Gosudarstvennyi Meditsinskii Inst. (I) (USSR). Dept. of General Hygiene.

For primary bibliographic entry see Field 5C.

W78-07298

**WATER HYACINTHS AND ALLIGATOR WEEDS FOR FINAL FILTRATION OF SEWAGE.**

National Space Technology Labs., Bay Saint Louis, MS.

B. C. Wolverton, R. C. McDonald, and J. Gordon. Available from the National Technical Information Service, Springfield, VA 22161 as N76-27721. Price codes: A02 in paper copy, A01 in microfiche. NASA Technical Memorandum TM-X-72724, interim program test results, May 1975. 8 p, 2 tab, 19 ref. RTOP 644-02-02.

Descriptors: \*Biological treatment, \*Sewage treatment, \*Water hyacinth, \*Alligatorweed, \*Sewerage lagoons, Tertiary treatment, Mississippi, Eichhornia crassipes, Alternanthera philoxeroides, Beneficial use, Nutrient removal, Toxins, Pollutants, Water pollution control, Algae, Foods, Feeds, Aquatic weeds.

Water hyacinth (Eichhornia crassipes) and alligatorweed (Alternanthera philoxeroides) removed 60-98% of various pollutants from domestic sewage in tests of their usefulness as secondary and tertiary filtration systems. Plants were tested with influent and effluent sewage water samples from the wastewater lagoon at Bay St. Louis, Mississippi. Water hyacinth achieved average reductions in influent samples of 92% Kjeldahl nitrogen (control 18%), 60% total phosphorus (control 12%), and 97% BOD5 (control 61%). In effluent samples the reductions were 75% suspended solids (control 15%), 75% total Kjeldahl nitrogen (control 15%), 87% total phosphorus (control 11%), 77% BOD5 (control 6%), and 82% total organic carbon (control increased 28%). In all effluent samples exposed to water hyacinth or alligatorweed there was no evidence of algae after two weeks. Alligatorweed-treated influent increased in pH from 7.1 to 7.4 over two weeks, and effluent decreased from 8.9 to 7.2. After two weeks alligatorweed achieved reductions in influent of 98% total Kjeldahl nitrogen and 71% total phosphorus. For effluent the reductions were 87% total suspended solids, 83% total Kjeldahl nitrogen, 59% total phosphorus, and 90% BOD5. Both plants also removed toxic trace metals, but were free of toxic levels of the metals after a two-week growth period, rendering them suitable for feed or food products. (Lynch-Wisconsin)

W78-07299

**NEW SYSTEM CUTS PHOSPHORUS FOR LESS COST.**

Union Carbide Corp., Tonawanda, NY. Environmental Systems Dept.

R. F. Dnevič, and L. M. LaClair. Water and Wastes Engineering, Vol. 9, p 104-107. 5 fig, 1 tab. (1972).

Descriptors: \*Phosphorus, \*Nutrient removal, \*Waste water treatment, \*PhoStrip process, \*Treatment facilities, Stripper, Supernatant, Biological treatment, Chemical precipitation, Lime, Hydrogen ion concentration, Nutrients, Water pollution control, Costs, Sludge disposal, Anaerobic conditions, Cost-effectiveness, Microorganisms.

A new wastewater treatment process called PhoStrip combines biological and chemical/physical methods of phosphorus removal and minimizes chemical needs and sludge disposal costs through increasing phosphorus removal efficiency by concentration phosphorus into a small stream. Although capital costs generally are greater than for a conventional chemical addition system, overall savings offset the higher initial cost. A plant being installed at Reno, Nevada will save an estimated \$750,000 in annual operating costs and \$500,000 in total annual evaluated costs, including investment. Biologically, the system takes advantage of the ability of microorganisms to store and release nutrients. Sludge from the secondary clarifier flows to a holding tank (the stripper), which holds the sludge in an anaerobic condition for 4-8 hours. Anaerobiosis causes phosphorus release from the solids and solubilization in the liquid. Typical phosphorus concentrations produced in the stripper are 40-70 mg/l. By separating this phosphorus-rich supernatant from the sludge, a low-volume flow is made available for phosphorus removal. Addition of lime causes the phosphorus to precipitate from the supernatant when pH exceeds 9.9; the low volume of the supernatant stream reduces the cost of chemicals consumed. The sludge is withdrawn from the stripper and returned to the anaerobic basin. Solutions to the problem of attaining a high concentration of phosphorus in the supernatant are presented. (Lynch-Wisconsin)

W78-07301

**PARTICLE DISRUPTION IN FLOCCULATING SYSTEMS.**

Missouri Univ.-Columbia. Dept. of Chemical Engineering.

For primary bibliographic entry see Field 5F.

W78-07321

**MONITORING OF WATERS FOR BDELLOVIBRIO BACTERIOVORUS - A PARASITE OF GRAM NEGATIVE ENTERIC BACTERIA PRESENT IN SEWAGE.**

Auburn Univ., AL. Dept. of Microbiology.

For primary bibliographic entry see Field 5A.

W78-07323

**SUGGESTED METHOD FOR VANADATE REMOVAL FROM MILL EFFLUENTS.**

J. G. Michalovic, J. G. Fisher, and D. H. Bock.

Descriptors: \*Vanadate ions, \*Mills, \*Effluents, \*Water pollution control, \*Waste water treatment, \*Vanadium, Industrial wastes, Mine wastes, \*Chemical precipitation, Aeration, Ferric hydroxide, Oxidation, Hydrolysis, Evaporation.

A process for removing vanadium as vanadate ion from mill effluents is described, based on coprecipitation. The process, involving excess hydroxide formed by oxidation and hydrolysis of ferrous sulfate, consistently yields vanadate concentrations less than 4 mg/l. The process was suggested by results of a recent survey of ore mining and milling operations, in which an evaporation pond containing vanadium at concentrations of about 100 mg/l had seepage with vanadium levels less than 10 mg/l. Pond pH was 1.5-2.0, while the leak had pH 4.0. Other information indicated high iron content as well as presence of other electrolytes in the pond. Experiments for this study were performed at initial pH levels of 2, 4, and 6, and at initial vanadium concentrations of 20, 50, and 200 mg/l. The pH of the solutions was monitored under three conditions: (1) after addition of stoichiometric, (2) 2.5 times stoichiometric, and (3) 5 times stoichiometric concentrations of ferrous sulfate. Aeration did not substantially increase pH. Higher vanadium removal was noted in solutions with lower initial pH. Increased removal of vanadium occurred with longer settling times; poor removal occurred at pH 9. High dissolved solids concentrations did not appear to interfere with removal. (Lynch-Wisconsin)

W78-07332

**GAMMA RAY TREATMENT REAPS HARVEST FROM SEWAGE.**

Environmental Protection Survey, p 21, February, 1978, 2 fig.

Descriptors: \*Gamma rays, \*Irradiation, \*Disinfection, \*Sewage sludge, \*Sludge treatment, Disinfection, Fertilizers, Pathogenic bacteria, Salmonella, Animal parasites, Cobalt radioisotopes, Cesium, Waste water treatment, Municipal wastes.

Disinfection by gamma irradiation is promoted for sewage sludge used as fertilizer. Irradiation with cobalt-60 or cesium-137 is conducted in a 7 m-deep shaft with a concrete shield. The radioactive material is enclosed in a corrosion resistant steel pipes contained in a closed flushing water circuit; sludge is automatically circulated around the radioactive material. The irradiation process effectively destroys pathogens and parasitic worm ova, as well as seed germination capability. The disinfection process maintains the fertilizer value of the sludge and increases the dewaterability by up to 50%. Gamma radiation does not produce pollutants or utilize oxygen or hydrocarbon fuels. About 12% of the cobalt-60 must be replaced each year; cesium-137 lasts about 10 years, making it slightly less expensive. The packaged disinfection plants are currently available in sludge output capacities of 1-250 cu m/day and 15 cu m/day. (Lisk-FIRL.)

W78-07333

**DATA REPORT—MARSH/POND SYSTEM,**

Brookhaven National Lab., Upton, NY. Dept. of Applied Science.

M. M. Small. Available from the National Technical Information Service, Springfield, VA 22161 as BNL-50600. Price codes: A03 in paper copy, A01 in microfiche. Report BNL-50600, November 1976, 28 p, 16 fig, 2 tab, 12 ref.

Descriptors: \*Biological treatment, \*Sewage effluent, \*Marshes, Water quality, \*Nutrient removal, Nitrogen, Phosphorus, Dissolved oxygen, Wetlands, Waste water, Soil filters, Artificial recharge.

Data from the first year of operation of the Marsh/Pond semi-works at Brookhaven National Laboratory are reported. Sewage is first aerated, then passed through a marsh, then through a pond, and finally, is spread on a forest floor to recharge groundwater supplies. Since the system is still under study, detailed conclusions would be premature; however, it was observed that a Marsh/Pond system will convert weak sewage to water suitable for recharge through a vegetated sandy loam. (Stihler-Mass)

W78-07338

**ROTATING DISC SEWAGE TREATMENT SYSTEMS FOR SUBURBAN DEVELOPMENTS AND HIGH-DENSITY RESORTS OF HAWAII,**

Hawaii Univ., Honolulu. Water Resources Research Center.

G. T. Griffith, H. F. Young, and M. J. Chun. Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 806. Price codes: A02 in paper copy, A01 in microfiche. Technical Memorandum Report No. 56, January 1978, 14 p, 2 fig, 3 tab, 14 ref. OWR A-068-HI(1), 14-34-0001-7025.

Descriptors: \*Rotating disc components, \*Biological treatment, \*Waste water treatment, \*Sewage treatment, \*Hawaii, Hawaii, \*Extended aeration, \*Aeration.

Experience with extended plants in high density resort and suburban development in Hawaii has

been generally unsatisfactory due to (1) inadequate system management resulting from insufficient manpower resources, and (2) high energy input required for aeration. A large scale pilot rotating disc unit was developed and field tested as a practical alternative to such extended aeration systems. A literature review on rotating disc systems provided information on the basic theory of operation, pilot plant sizing and configuration, pilot system operation and data-gathering techniques, and hydraulic and organic loading rates. Laboratory operation of a bench-scale (6-in. diameter discs) unit led to the conclusion that movement of solids within the unit would be a major problem. A large-scale pilot unit (2-ft diameter discs) was designed and fabricated to remove 85% BOD from 1000 gpd raw domestic sewage. The unit provides for primary settling, four-stage bio-disc biological treatment, final clarification and capacity for 50-day sludge storage and anaerobic digestion. The pilot unit has been installed and operated at the City and County of Honolulu's Pacific Palisades Wastewater Treatment Plant. Results from loading rates of 2.2 and 4.0 gpd/ft<sup>2</sup> are encouraging with 80-90% BOD and better than 90% SS removed. Further evaluation of the data as well as performance studies at other loading rates are continuing.

W78-07393

**DETERMINATION OF TOTAL ORGANIC CARBON IN POTABLE WATER, SEWAGE, INDUSTRIAL EFFLUENTS, AND BOILER FEED WATER,**

Badische Anilin- und Soda-Fabrik A.G., Ludwigshafen am Rhein (West Germany). For primary bibliographic entry see Field 5A.

W78-07404

**ALUM TREATMENT OF HIGH-RATE TRICKLING FILTER EFFLUENT AT CHAPEL HILL, NORTH CAROLINA,**

North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.

J. C. Brown. In: Ultimate Disposal of Wastewaters and Their Residuals, April 26-27, 1973, Raleigh, North Carolina, Research Triangle Universities, p 153-177, 8 fig, 9 tab, 8 ref.

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Trickling filters, Sludge, Sludge treatment, Anaerobic digestion, Biochemical oxygen demand, Phosphorus, \*North Carolina, Alum.

Promising results achieved by adding alum to the trickling filter effluent at a plant at Richardson, Texas, encouraged the EPA to contract the UNC Wastewater Research Center to experiment with alum addition at the high-rate trickling facility at Chapel Hill's (North Carolina) Mason Farm Treatment Plant. Treatment of high-rate trickling filter effluent with alum is an effective measure to upgrade plant performance and improve phosphorus removal. Alum dosages between 165 and 250 mg/liter and Al:P mole ratios between 1.5 and 2.2 were effective at the Chapel Hill plant. A combination of alum and organic sludge can be satisfactorily anaerobically digested. Decreases in pH and digester alkalinity were corrected by the addition of lime. Recommendations include: additional final settling tank capacity; a design overflow rate of 500 gpd/sq ft, based on an average daily flow; a flow paced alum feeding system for alum application; and, separate facilities for handling the aluminum sludges from final settling tanks. The separate sludge handling facilities are recommended because of the increase in wet digester sludge resulting from the addition of alum. If the entire Chapel Hill plant flow were treated with alum, the sludge volume would increase about 2.4 times normal. Alum addition to trickling filter effluent can result in BOD removal of 95%, and phosphorus removal of 90%. (Orr-FIRL.)

W78-07409

**PIPING MATERIALS: LITTLE FUROR; SOME CHANGE.**

For primary bibliographic entry see Field 8G. W78-07414

**DUCTILE-IRON PIPE GALLERY.**

For primary bibliographic entry see Field 8G. W78-07416

**HISTORY OF SEWAGE PUMPING IN BRITAIN.**

For primary bibliographic entry see Field 8C. W78-07417

**HOSCAR'S EXTENSION SHOULD DEODORIZE THE DOUGLAS,**

B. Appleton. New Civil Engineer, p 18-19, January 12, 1978, 1 fig.

Descriptors: \*Treatment facilities, \*Sewers, \*Conveyance structures, \*Biological treatment, \*Filters, Incineration, Sludge treatment, Sludge disposal, Sewage disposal, Pumping plants, Waste water treatment, Municipal wastes.

An 11.6 km-long trunk sewer was constructed to transport sewage from Pemberton, England, to the Hoscarr biological filtration plant. The 1.85 m-diam concrete pipe required a steel shield for trench support and 5 km of wellpoints for soil dewatering during installation. The flow capacity of the trunk line was increased to 4.8 cu m/sec. Improvements at the Hoscarr treatment plant are expected to increase the capacity to 1.8 cu m/sec by 1981 and improve the plant's treatment of industrial waste water. Activated sludge as unsuccessful in treating the filamentous bacteria in the effluent. Five hectares of biological filter beds were designed to incorporate vibroflotation and blast furnace slag. The Hoscarr plant also contained circular humus tanks and pumping stations equipped with Archimedeian screw pumps built on piled foundations. Because the sludge was unsuitable for land application, a 13.5 m-high multi-hearth incinerator equipped with stack gas scrubbers was selected for sludge disposal. (Lisk-FIRL.)

W78-07418

**SEWERS ... THE CLEANER, THE BETTER.**

For primary bibliographic entry see Field 8G. W78-07420

**GROUTING PROVIDES ECONOMICAL AND EFFECTIVE MAINTENANCE IN KANSAS,**

Wichita Sewer Maintenance Office, KS. For primary bibliographic entry see Field 8G. W78-07421

**NATIONAL NEEDS FOR COMBINED SEWER OVERFLOW CONTROL,**

Metcalf and Eddy, Inc., Boston, MA. M. D. Giggie, and W. G. Smith. Journal of the Environmental Engineering Division-ASCE, Vol. 104, No. EE2, p 351-366, April, 1978, 4 fig, 8 tab, 10 ref.

Descriptors: \*Combined sewers, \*Overflow, \*Storm water, \*Capital costs, \*Operation and maintenance, Treatment facilities, Disinfection, Storm runoff, Storage, Storage requirements, Sewers, Waste water treatment, Municipal wastes.

Costs and design efficiencies of eight hypothetical combined sewer overflow systems were analyzed according to American Public Works Association and EPA Needs Survey standards. Basic control and treatment objectives of combined sewer overflow with rainfall data as a factor were applied to characteristics of existing systems. Six of the hypothetical control systems treat combined sewer overflow and swirl concentrator underflow separately. The other two options store the over-



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

flow until the storm subsides and the waste water can be handled within the dry-weather capacity of the treatment facility. The first option provides disinfection without storage at a total cost of \$13.046 billion. The second \$54.360 billion option offers primary clarification and disinfection with in- and off-line storage. The third option, costing \$68.400 billion, employs secondary treatment and disinfection with in- and off-line storage. Depending on the receiving water standards, the fourth option incorporates disinfection with or without primary treatment with in- and off-line storage at a cost of \$34.200 billion. Similarly, the \$62.380 billion fifth control option employs disinfection with primary or secondary treatment. The \$25.073 billion sixth system, with off-line storage of underflow, uses swirl concentration with disinfection of overflow and discharge of underflow to existing treatment plants. The seventh system, costing \$1.320 billion, provides in-line treatment of stored runoff at a treatment facility. The \$6 billion option 8 provides the same treatment as system 7 with off-line storage of the 'first flush.' Total BOD and suspended solids capacities range over 310-660 and 450-2260 thousand tons/yr respectively, for the eight combined sewer overflow control strategies. (Lisk-FIRL)  
W78-07422

#### BORING MACHINES PICK UP SPEED ON DEEP CHICAGO SEWER TUNNELS.

For primary bibliographic entry see Field 8C.  
W78-07423

**SLUDGE DISPOSAL: THE PROBLEM, THE SEARCH, THE SOLUTION.**  
Rickel Mfg. Corp., Kansas City, MO.  
R. Haag.  
Public Works, Vol. 109, No. 3, p 58-61, March, 1978.

Descriptors: \*Sludge disposal, \*Activated sludge, \*Anaerobic conditions, \*Sludge treatment, \*Fertilizers, Agriculture, Sludge digestion, Waste water treatment, Municipal wastes.

The sewage sludge land application system used by the Moorhead waste water treatment plant in Minnesota is described. The anaerobic digestion treatment system serves a population of 35,000, producing 30,000 gal/day raw sewage. The plant has a design capacity of 4.5 mgd with a 95% BOD and suspended solids removal efficiency. Two tank trucks with capacities of 3,000 and 3,500 gal were replaced by the high flotation Big A 4500 truck manufactured by Rickel Manufacturing Corp of Salina, Kansas. The high-flotation truck allowed sludge application to thawing ground which had previously been inaccessible during the spring. The municipality transports 70,000 gal/week of whey and ice cream wash water from a local dairy products manufacturer which financed the high-flotation truck. This arrangement has reduced the treatment plant's BOD load by 1,500-2,000 lbs/day and the dairy's sewerage charges from \$77,000 to \$36,000. Approximately 3.5 tons of sludge are applied to each acre at a cost of \$87.50/acre; the nitrogen and phosphorus pentoxide value of the sludge as fertilizer is approximately \$74.20/acre. (Lisk-FIRL)  
W78-07424

**TREATMENT AND USE OF SEWAGE PURIFICATION PLANT SLUDGES.**  
Didier (J. M.) and Associates, Brussels (Belgium).  
K. Brekelmans, and H. Hall.  
Water Services, Vol. 81, No. 975, p 264, 266-268, May, 1977. 1 tab, 7 ref.

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Dewatering, \*Methane, \*Anaerobic conditions, Pathogenic bacteria, Animal parasites, Incineration, Nitrogen, Phosphorus, Odor, Waste water treatment, Municipal wastes.

Methods of sewage sludge treatment, use, and disposal are evaluated. Various parameters of raw or primary sludge and digested or secondary sludge are reviewed, including: pH, dry residue, fat, protein, carbohydrates, lignins, and ash content. The production of sludge gas at a rate of 0.6 cu m/kg of organic matter by anaerobic fermentation converts the organic matter into methane and carbon dioxide without nitrogen loss. Anaerobic fermentation also reduces the pathogens, parasitic worm ova, grease, and odor and breaks down organic nitrogen and phosphates. Disposal of sludge into the sea, onto the land, or through incineration, is reviewed; land application of stabilized, digested sludge has the advantage of providing plant nutrients to the soil. Sludge dewatering techniques with cationic or polyelectrolytic conditioning agents, flotation, and centrifugation are discussed; the need for sterilization of the dewatered sludge before land application is stressed. (Lisk-FIRL)  
W78-07425

**THE USE OF FILTERBELT PRESSES FOR DEWATERING OF SEWAGE SLUDGES.**  
H. O. Howell.  
Water Pollution Control, Vol. 77, No. 1, p 66-68, 1978. 2 fig.

Descriptors: \*Sludge treatment, \*Dewatering, Equipment, \*Hydraulic structures, \*Flocculation, Chemical treatment, Polyelectrolytes, Pressure, Shear, Anaerobic conditions, Waste water treatment, Municipal wastes.

Filterbelt presses for sludge dewatering with chemical conditioning, pressurization, and shearing are discussed. Chemically flocculated sludge is fed to the filterbelt press for gravitational dewatering by positive displacement pumps. Pressure is exerted on the dewatered sludge as the filter belts converge; shearing or bending of the sludge further releases water, producing a final 99% solids sludge. New designs in filterbelt presses are based on one or both belts constructed of mesh with a longer shearing stage and reversible roller support cages. The choice of chemical flocculant, diluted to 0.05-0.1%, determines the optimum sludge conditioning for dewatering. The belt speed of the press is linearly related to the filter cake quality; higher pressures result in more extensive moisture removal. Anaerobically digested primary sludges are more easily dewatered and have higher solids contents. Filterbelt presses offer low maintenance costs, capital outlay, and labor costs; a high quality sludge cake is produced within a short operation period. The presses also are compact and provide aerobic conditions to prevent phosphorus release from the sludge. (Lisk-FIRL)  
W78-07426

**PROBLEMS ENCOUNTERED IN THE UP-GRADING OF SOME SMALL SEWAGE WORKS.**  
A. L. Abbott, and I. B. Law.  
Water Pollution Control, Vol. 77, No. 1, p 106-111, 1978. 4 fig, 6 tab.

Descriptors: \*Treatment facilities, \*Optimization, \*Activated sludge, \*Performance, \*Peak loads, Settling basins, Aeration, Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demand, Population, Filters, Tertiary treatment, Waste water treatment, Food processing industry, Municipal wastes.

A treatment plant with a design capacity of 5.45 million liters/day employing primary and secondary digestion was redesigned for a potential capacity of 12 million liters/day and upgraded for tertiary treatment. Additional settling basins and tertiary filters were incorporated into the plant; existing settling tanks were converted to humus tanks and secondary filters to tertiary filters. Part of the effluent was stored for industrial use and the rest was used for irrigation. The second treatment

plant, employing the activated sludge process, lacked nitrification and had a COD removal rate of 81%. To increase the low dissolved oxygen concentration, a digester tank was redesigned as an aeration tank and larger aerators were installed. The third plant, treating a combined flow of municipal and cannery wastes, was overloaded by 80-90% during the canning season. Performance testing of the filter yielded a 28% COD removal efficiency and a 36% BOD removal capacity. Secondary filtration was installed to provide 60% COD removal during the canning season. The fourth facility with a design capacity of 3.4 million liters/day had 100% overloading; sand filters were converted to secondary humus tanks; a sludge dewatering tank was installed; and mechanical mixing was replaced with gas mixing. The oxidation pond, originally constructed for use by the two towns served by the facility, was converted to use by one town with a flow of 1.36 million liters/day. (Lisk-FIRL)  
W78-07427

**EFFLUENT TREATMENT PLANT FOR THE SMALLER COMMUNITY.**  
Hudson (Robert (Raletrux) Ltd., Leeds (England).  
A. Ward.  
Water Services, Vol. 81, No. 982, p 751-752, December, 1977. 3 fig.

Descriptors: \*Sludge treatment, \*Construction materials, \*Design data, \*Sludge disposal, \*Screens, Waste water treatment, Rural areas, Equipment, Municipal wastes.

Three designing units, manufactured by Robert Hudson Ltd of Leeds, Yorkshire, England, provide sludge screening and scraping for small waste water flows. The Hudson Bioscreen incorporates a bar screen mounted within a rectangular section channel. The bar screen is angled at 30 degrees to the water surface, effectively increasing the screening area at any channel width. The Rotosludge unit contains a half bridge scraper with adjustable blades in a circular tank. The system is manufactured in standard modules which allow custom, low-cost installation. The rectangular tank Autosludge scraper unit, also built in standard modules, provides savings in capital and installation costs that can be returned within five years. The Autosludge unit, constructed of corrosion resistant materials, is almost entirely submerged during operation. (Lisk-FIRL)  
W78-07428

**FILTER SACK DEWATERING.**  
Water Services, Vol. 81, No. 982, p 757-758, December, 1977. 1 fig.

Descriptors: \*Sludge treatment, \*Dewatering, \*Filtration, \*Membrane processes, \*Separation techniques, Polyelectrolytes, Flocculation, Equipment, Filters, Sewage sludge, Waste water treatment, Municipal wastes.

A Degremont Laing filter sack sludge dewatering system is capable of high drying performance with a compact and adaptable design. A 1.0 m diameter Trevira polyester fiber sack hangs vertically within a 2.50 m high cylinder. The polyester fiber is resistant to the chemical and physical degradation by waste water. Sludge is first flocculated with a polyelectrolyte in a rotating drum; it is then passed into the polyester filter sack. The unit can accommodate up to six sacks having sludge capacities up to six times the volume of the sack. The filtrate seeps through the sack and is directed onto a sloped plate at the base of the unit. A slide valve at the bottom of the sack, through which sludge is removed, allows for a very dry sludge where required. The retention time of the sludge in the sack determines its final moisture content. A retention time of 30 min produces 29% solids; the solids content is increased 35% and 40% after retention times for 2 and 18 hrs, respectively. (Lisk-FIRL)  
W78-07429

**ODOR AND CO**  
Water Service  
December, 1977

Descriptors: \*Control, \*Hydrogen peroxide, \*Pumps, Sulfate, plants, Municipal

Hydrogen peroxide sulfidic activity in sewer Severn-Trent gland. The data cu m with a t sewer main du night. The sul was 6-20 ppm ing station. H the sewer main container. A mg/liter of se of sulfide. TI averaged 6 kg summer mont was 200 pound of 1.50 pound W78-07430

**AERATION TIES.**  
Water Service  
December, 1977

Descriptors: \*Aerobic tr \*Design data Aerated lago ment, Municipal

Aeration pla wastes from by Satec TL aeration unit up to 600 and constructed of installation plant operate activated sludge structures a range. The c operate on the technique. I bilization ac 1150-18,000, concrete tank tions of 1, rectangular ment tank h tion. (Lisk-F W78-07431

**WASTEWATER**  
Water and S  
26, March, 1978

Descriptors: \*Measurem materials, I tion, Waste water treat disposal, M

A water m burg, Flor water lines for irrigati average rain fluent contr kler system Approxima the distribu ration rate color and selected to

**ODOR AND CORROSION CONTROL.**

Water Services, Vol. 81, No. 982, p 752-753, December, 1977.

Descriptors: \*Sulfides, \*Odor control, \*Corrosion control, \*Hydrogen, \*Sewage bacteria, Sewers, Pumps, Sulfates, Waste water treatment, Pumping plants, Municipal wastes.

Hydrogen peroxide treatment of odorous and corrosive sulfides produced by anaerobic microbial activity in sewer mains was demonstrated by the Severn-Trent Water Authority in Wimpstone, England. The daily waste water flow averaged 30-40 cu m with a three hr waste retention time in the sewer main during the day, increasing to 7 hrs at night. The sulfide content at the pumping station was 6-20 ppm and up to 10 ppm beyond the pumping station. Hydrogen peroxide was injected into the sewer main by a pump equipped with a storage container. A hydrogen peroxide dose of 180 mg/liter of sewage resulted in adequate oxidation of sulfide. The daily hydrogen peroxide dosage averaged 6 kg; treatment was required only in the summer months. The total cost of the installation was 200 pounds sterling, with a daily chemical cost of 1.50 pounds. (Lisk-FIRL)

W78-07430

**AERATION PLANT FOR SMALL COMMUNITIES.**

Water Services, Vol. 81, No. 982, p 753-754, December, 1977.

Descriptors: \*Aeration, \*Activated sludge, \*Aerobic treatment, \*Construction materials, \*Design data, Settling basins, Aerobic conditions, Aerated lagoons, Equipment, Waste water treatment, Municipal wastes.

Aeration plants designed for the treatment of wastes from small populations, are manufactured by Satec Ltd of Cheshire, England. The Satec aeration units for communities with populations up to 600 and up to 2,300 are rectangular structures constructed of steel in factory built form for ease of installation or in small plate form. The aeration plant operates on the extended aeration method of activated sludge treatment. Concrete aeration structures are also manufactured for this size range. The concrete aeration and settlement tanks operate on the diffused air or mechanical aeration technique. Diffused air plants with contact stabilization are manufactured for populations ranging 1150-18,000, using a circular steel tank or a concrete tank with an inner steel tank. For populations of 1,500-25,000, a mechanically aerated rectangular tank with a separate circular settlement tank has been developed for extended aeration. (Lisk-FIRL)

W78-07431

**WASTEWATER SYSTEM PROVIDES NEW WATER SOURCE FOR ST. PETERSBURG.**

Water and Sewage Works, Vol. 125, No. 3, p 18, 26, March, 1978.

Descriptors: \*Flowmeters, \*Instrumentation, \*Measurement, \*Return flow, \*Construction materials, Distribution systems, Sprinkler irrigation, Waste water, Irrigation programs, Waste water treatment, Potable water, Waste water disposal, Municipal wastes.

A water metering system installed in St. Petersburg, Florida distinguishes between the potable water lines and the secondary effluent lines used for irrigation water. Because of a lower than average rainfall in the Tampa Bay area, treated effluent containing nutrients was directed to a sprinkler system for municipal and private irrigation. Approximately 10,000 meters will be installed at the distribution points to monitor the water application rates and to curtail runoff. A combined color and manufacturer coding system was selected to distinguish the secondary effluent

system from the more than 90,000 water meters in the area. A blue plastic meter, produced by Kent Meter Sales, Inc., was selected over its bronze counterpart. The plastic meter is corrosion resistant, does not form metal oxides, and costs \$10 less than bronze meters. Installation of the plastic meter is expected to reduce the meter discard rate from 6,000/yr to 1,000/yr during upgrading of the system. (Lisk-FIRL)

W78-07432

**OPERATIONAL EXPERIENCE AT THE BORCHERDS QUARRY WASTEWATER TREATMENT WORKS.**

P. B. King. Water Pollution Control, Vol. 77, No. 1, p 111-112, 1978.

Descriptors: \*Activated sludge, \*Aeration, \*Screens, \*Settling basins, \*Sludge, Treatment facilities, Chemical oxygen demand, Denitrification, Ammonia, Waste water treatment, Municipal wastes, Domestic wastes.

The operation of a waste water treatment facility with a population capacity of 55,000 was discussed. The treatment included screening, dewatering, and metering of the influent before transport via a sump to a 5,580 cu m aeration tank. Liquid separated from the sludge in a settling tank was passed through three maturation ponds before discharge into a river. The initial capacity of the plant was 3,750 cu m/day with an average flow less than 7% of the design flow. The flow was increased to 425 cu m/day by diversion of conservancy water to the plant and by discharge of domestic wastes to the plant four days a week to increase the organic load. With the additional discharges, the population equivalent was increased to 34,500, based on a 110 g COD/day concentration. Influent samples on days when domestic sewage was discharged to the plant contained 50,000 mg/liter COD and 2,500 mg/liter ammonia nitrate. Maturation of the treated effluent in lagoons for 60 days reduced the COD concentration to 150 mg/liter and ammonia nitrate levels to 1 mg/liter. Upgrading of the plant to a population capacity of 55,000 was accomplished by the addition of two aerators, a settling tank, and a screw pump. Two screens were added in the grit channel to supplement a hand-raked bypass screen that was subject to clogging. Activated sludge was returned to the sewage sump to reduce pump blockage, eliminate odors, increase denitrification, and maintain sludge return during power failure. (Lisk-FIRL)

W78-07433

**OZONE IN THE TREATMENT OF ODORS FROM SEWAGE WORKS.**

A. Elphick, and G. E. Favell. Water Services, Vol. 81, No. 975, p 280-282, May, 1977. 1 fig.

Descriptors: \*Ozone, \*Activated carbon, \*Odor, \*Operation and maintenance, \*Hydrogen sulfide, Costs, Sewage treatment, Adsorption, Air pollution, Waste water treatment, Treatment facilities, Municipal wastes.

Ozone deodorization of municipal wastes was compared to chemical spraying and activated carbon methods of treating sewage odors. The substances primarily responsible for malodorous emissions from sewage are skatole, indole, hydrogen sulfide, and mercaptans. Chemical spraying of the wastes masks the sewage odor with an aromatic odor. Activated carbon adsorbs odorous skatole and mercaptans more readily than hydrogen sulfide. Replacement or regeneration of the activated carbon is required about five times a year. About 860 lbs of activated carbon at a cost of 900 pounds sterling are necessary for carbon adsorption of odorous substances. Wet well ozonation contacts the odorous substances for 7-10 min before discharge into the atmosphere. Continuous

operation of the deodorization process reduces the extraction rate and thus the ozone dose. A retention chamber, providing 20-30 seconds contact time, decreases the ozone injection to about 1.0 ppm. Operating costs for ozone deodorization total about 490 pounds sterling, primarily for the ozone generator's power supply. (Lisk-FIRL)

W78-07434

**THE DANGERS OF INADEQUATE CHLORINATION OF POLLUTED WATERS.**

National Inst. for Water Research, Pretoria (South Africa). E. M. Nupen, and W. S. G. Morgan. Water Pollution Control, Vol. 77, No. 1, p 45-50, 1978. 2 tab, 46 ref.

Descriptors: \*Chlorination, \*Disinfection, \*E. coli, \*Pathogenic bacteria, \*Viruses, Toxicity, Environmental effects, Fishkill, Salmonella, Sewage bacteria, Waste water treatment, Organic compounds, Chemical reactions, Municipal wastes.

The potentially harmful effects of residual chlorine compounds after chlorine disinfection are reviewed. Hypochlorous and hydrochloric acids, formed when chlorine is added to water, oxidize with nitrogen in the presence of sewage reducing agents to chloramines and free chlorine. Monochloramines must be oxidized to convert ammonia to free nitrogen and to allow disassociation of hypochlorous acid for disinfection. Although E. coli may be eliminated before the breakpoint, of ammonia conversion, viruses and parasite eggs are removed after breakpoint. Chlorine also combines with other organic substances to form toxic chlorinated compounds, such as chlorophenols and potassium sulfoxyanide. Tests with some of these compounds indicate that fish egg hatching was retarded by concentrations of 4-chlororesorcinol and 5-chlorouracil as low as 0.001 mg/100 ml of water. Limits established by the United States Environmental Protection Agency allow the discharge of 0.003 mg/liter of residual chlorine, with concentrated residual chlorine discharges containing up to 0.05 mg/liter permitted for 30 min within a 24 hr period. In addition to its toxicity to some fish, chlorine has also been shown to eliminate beneficial heterotrophic organisms while pathogenic organisms remained unaffected. (Lisk-FIRL)

W78-07435

**THE THICKENING AND CENTRIFUGING OF SLUDGE.**

C. M. Howarth. Water Pollution Control, Vol. 77, No. 1, p 64-65, 1978.

Descriptors: \*Dewatering, \*Sludge treatment, \*Sludge disposal, \*Centrifugal pumps, \*Centrifugation, Separation techniques, Valves, Pumps, Incineration, Influent streams, Waste water treatment, Municipal wastes.

Methods to improve sludge dewatering and thickening by centrifugation are presented. Investigations were conducted at a treatment plant where a combined municipal and industrial influent was thickened, centrifuged to 25-30% solids content, and incinerated in a fluidized sand bed. Centrifuge performance was upgraded by providing a second thickener; a thick sludge was consistently produced, reducing fuel consumption in the incinerator. Pump wear was reduced by installing a large Mono pump operated at lower speeds. The Mono pump was custom-designed with a spring-operated diaphragm valve for pressure relief during restricted sludge output. Disintegrator pumps, through which the sludge was passed from the thickening tanks to a manifold, were replaced by hand raking operations. Uneven flows to the four centrifuge pumps were eliminated by installing two header tanks equipped with diaphragm valves. Centrate backup into the centrifuges was alleviated by collecting centrate in

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

a sump from which it was pumped to the disposal pipes. Cake dryness increased with greater flow rates; solids recovery decreased with the decrease in liquid retention. Because of its higher oil content, centrate had a 20% higher energy value than the feed sludge or the sludge cake. (Lisk-FIRL) W78-07436

#### HEAT TREATMENT AND PRESSING OF DIGESTED SLUDGE,

I. Everitt.

Water Pollution Control, Vol. 77, No. 1, p 62-63, 1978.

Descriptors: \*Activated sludge, \*Sludge digestion, \*Heat treatment, \*Dewatering, \*Pumps, Outlets, Sludge treatment, Sludge disposal, Treatment facilities, Waste water treatment, Municipal wastes.

Solutions to problems encountered in two waste water treatment plants in South Africa were presented. Sludge treatment process at both plants included digestion, heat treatment, dewatering, and pressing; an additional sludge thickening stage was present at one plant. Ram pumps at both treatment sites developed cracked cylinders; outlet valves became worn and cracked. Replacement of the ram pumps with Mono pumps was only satisfactory; rotors and stators were abraded by grit. Replacement of the outfall valves with flat valves proved successful. Clogging and bursting of the inner tubes removing treated sludge from the heat exchangers were alleviated by regular washing with a high-pressure water jet and replacement of coil seals with Teflon-wrapped copper seals. Level probes in the pressure vessels required cleaning; the stainless steel discharge valves were replaced with more wear-resistant hardened tool steel and tungsten carbide. The nine presses, each with 55 cast iron plates, developed cracked plates within four years. The cast iron plates in the presses, operating at 65 kilopascals, were replaced with polypropylene plates. Odor from the decant tanks was abated by covering the tanks with floating plastic balls. Decantrates and filtrates with permanganate values of 2,000 mg/liter were introduced into the activated sludge units for clarification. (Lisk-FIRL) W78-07437

#### SEWAGE SLUDGE LIME DOSING AND FILTER PRESS FEEDING.

Water Services, Vol. 81, No. 975, p 289-290, May, 1977.

Descriptors: \*Sludge treatment, \*Dewatering, \*Lime, \*Pumps, \*Instrumentation, Measurement, Design data, Sewage sludge, Filtration, Waste water treatment, Municipal wastes.

A mixing, pressing, and pumping system was developed by Mono Pumps Ltd of London, England, for lime dosing during the sludge dewatering. The Mono system eliminates the need for a water source, a mixing tank, a mixer and transfer pump, and pressure maintenance during periods when the pump is idle. The Mono pump, equipped with a cylindrical Monomix unit, draws sewage sludge from the conditioning tank into the chamber while creating a whirlpool action. Proper doses of dry lime are injected at the Monomix into the center of the vortex; adequate mixing is ensured by the pump element. The lime-bearing sludge is returned to the conditioning tank for copperas solution treatment before passing to the filter press for dewatering. The need for pressure vessels is eliminated by the variable speed drive of the Mono Presspack's pump. Constant torque, corresponding to the potentiometrically controlled press pressure, is supplied by the electrically controlled pump. Pressure is maintained within 5 lb/sq in of the required value, producing a uniform filter cake. The unidirectional sludge flow eliminates the need for maintenance of non-return valves. (Lisk-FIRL) W78-07438

#### SEWAGE TREATMENT EQUIPMENT FOR SINGLE HOUSEHOLDS TO 5000 PE.

Water Services, Vol. 81, No. 982, p 746-747, December, 1977.

Descriptors: \*Septic tanks, \*Settling basins, Equipment, \*Construction materials, \*Filters, Biological treatment, Design data, Domestic wastes, Plastics, Waste water treatment, Municipal wastes.

Municipal or domestic waste water treatment equipment is manufactured for populations up to 5,000 by Klargest Environmental Engineering Ltd. A three-stage settlement tank is constructed of fiberglass-reinforced plastic for ease of handling and installation. Biological filters with pumps or gravity feed distributors are available for use in areas where effluent disposal is hindered by sub-soil conditions. Rotary disc-filters are produced as an alternative to biological filters. An unassembled septic tank provides a compact design, reduced handling and shipping charges, and simple assembly. An unassembled version of the three-stage settlement tank is also available. The fiberglass-reinforced plastic BioDisc unit is suitable for use in climates ranging from desert to sub-arctic. (Lisk-FIRL) W78-07439

#### BELT PRESS SLUDGE DEWATERING MACHINES.

Water Services, Vol. 81, No. 975, p 290, May, 1977. 3 fig. 1 tab.

Descriptors: \*Sewage sludge, \*Sludge treatment, \*Dewatering, \*Filters, \*Equipment, Design data, Incineration, Sieves, Pressure, Separation techniques, Waste water treatment, Municipal wastes.

Two belt press sludge dewatering systems, developed by the English Manufacturer Simon-Hartley, have capacities ranging 2-23 cu m/hr. The three-stage Winklepess dewaterers sludge after polyelectrolytic treatment. Consolidation and further dewatering are then performed in a vertical zone with a diminishing width; a final shear action is applied by bands passing over and under rollers positioned at varying heights. The Winklepess has an input width of up to 2,300 mm with a sewage sludge capacity up to 23 cu m/hr; it produces a combustible filter cake with 35% dry solids. The Simon-Hartley Type HF band press employs the same band and roller configuration as the Winklepess but eliminates the vertical dewatering and consolidation zone. The bands are sprayed before and after they pass over 15 rollers mounted in a continuous horizontal feed position. The band press is available in input widths ranging 200-1800 mm for sewage sludge capacities of 2-18 cu m/hr. (Lisk-FIRL) W78-07440

#### OPERATING ACTIVATED-SLUDGE PLANTS TO EFFECT NUTRIENT REMOVAL,

H. A. Nicholls.

Water Pollution Control, Vol. 77, No. 1, p 99-101, 1978.

Descriptors: \*Nitrification, \*Nitrates, \*Phosphorus, Eutrophication, \*Nutrient requirements, Anaerobic conditions, Oxygen demand, Suspended solids, Dissolved oxygen, Activated sludge, Waste water treatment, Municipal wastes.

Non-chemical methods to remove nitrogen and phosphorus from waste water during activated sludge treatment were presented. Nitrification occurred in an activated sludge operation at a retention time of 13 days and a dissolved oxygen content of 0.5-1.0 mg/liter. Nitrate removal was effected by establishing an anaerobic denitrification zone near the inlet of the treatment process where oxygen demand was the highest. Raw sewage provided electron donors to the nitrates by installing a

plug flow or semi-plug flow system at the treatment plant inlet to facilitate denitrification. Recycling of the nitrate-bearing mixed liquor suspended solids to the denitrification zone, in conjunction with the two previous steps, yielded a 90% nitrogen removal. Phosphorus removal was achieved by mixing influent and sludge from the clarifier in the absence of oxygen and nitrate. Phosphorus ions released into solution under anaerobic conditions were more readily readSORBED onto the sludge with aeration. Before the clarification step, the dissolved oxygen concentration of the mixed liquor suspended solids was maintained at 3.0-4.0 mg/liter to prevent the dissolution of the phosphorus ions. Disadvantages of nutrient removal in a single basin were discussed. (Lisk-FIRL) W78-07441

#### HYACINTHS FOR WASTEWATER TREATMENT,

J. Joseph.

Reeves Journal, Vol. 56, No. 2, p 34-36, February, 1978.

Descriptors: \*Water hyacinth, \*Absorption, \*Root systems, \*Rooted aquatic plants, \*Sewage treatment, Nutrient removal, Biochemical oxygen demand, Suspended solids, Coliforms, Nitrogen, Phosphorus, Proteins, Metals, Waste water treatment, Municipal wastes, Biological treatment.

Secondary treatment of waste water with water hyacinths produced significant reductions in impurities, coliforms, and heavy metals in pilot plant tests conducted by the National Space Technology Laboratory at Orange Grove, Mississippi. Biologically treated waste water from a population of 5,000 was introduced into an 0.7-acre hyacinth lagoon which was four to five times smaller than the primary aerated lagoon. Retention times of 14-21 days in the lagoon reduced suspended solids by an average of 72%, total nitrogen by 60%, total phosphorus by 26%, BOD to below standard levels, and coliforms from 121,000 to 40,000/100 ml. In the absence of toxins or metals, the harvested hyacinths yielded up to 25% crude protein for supplemental animal feed. An acre of hyacinths, producing from 8-16 tons wet biomass/day, generated 3,200-6,450 cu ft of methane gas/day with 0.5 ton fertilizer as a by-product. The water hyacinths were effective in removing lead, mercury, cadmium, cobalt, nickel, silver, and phenols. Research is being conducted to expand the hyacinth belt north of 33 degrees latitude. (Lisk-FIRL) W78-07442

#### BUCKLAND POLLUTION CONTROL CENTRE IMPROVES ENVIRONMENT IN THE SOUTH WEST.

V. H. French.

Water Services, Vol. 81, No 975, p 285-286, May, 1977.

Descriptors: \*Treatment facilities, \*Settling basins, \*Activated sludge, \*Aeration, Sludge treatment, Incineration, Lime, Aerated lagoons, Dewatering, Sludge disposal, Waste water treatment, Municipal wastes.

The Buckland sewage treatment plant, operated by England's South West Water Authority, is described. The treatment facility is designed for a population of 50,000 with provisions for expansion to a capacity of 100,000. The influent is screened before flowing into three settling basins equipped with half-bridge rotating scrapers for sludge removal. The waste water is then distributed to two three-sectioned aeration tanks equipped with 8 surface aerators and dissolved oxygen probes. The aerated effluent is passed into three secondary settling basins with rotating scrapers which remove activated sludge for return to the aeration tanks. Sludge is thickened, macerated, and conditioned with lime and copperas before it is pressed



and stored. A multi-hearth incinerator with a 2.5 ton/hr capacity operates 50 days a year for sludge disposal. Stack gases are treated in a multi-cyclone unit before discharge. (Lisk-FIRL)  
W78-07443

# RECENT ADVANCES IN OZONE TECHNOLOGY

CV,  
R. G. Rice.  
Water Pollution Control, Vol. 77, No. 1, p 51-55, 1978, 1 tab.

Descriptors: \*Ozone, \*Disinfection, \*Tertiary treatment, \*Chlorination, \*Sewage treatment, Industrial wastes, Suspended solids, Coliforms, Biochemical oxygen demand, Waste water treatment, Municipal wastes, Pilot plants, Treatment plants.

Ozonation has been used for the disinfection of sewage effluent, as well as tertiary treatment, dissolved organics removal, suspended solids reduction, and industrial waste water treatment. Ozonation has replaced chlorination in three small treatment plants in the United States and its use is planned in a number of other plants. Pilot plant investigations of disinfectants, including ozone, ultraviolet radiation, bromine chloride, and chlorine have demonstrated the ozonated waste water is less toxic than chlorinated effluent. Substantial BOD and COD level reductions have been realized with high-level ozonation. Ozone has not been as effective as chlorine in reducing dissolved organic materials in activated sludge effluent. In a California treatment plant, the need for chemical treatment of secondary effluent has been eliminated by pre-ozonation to remove suspended solids. The 10 mg/liter ozone treatment was 10% cheaper than chlorination but did not sufficiently remove coliform populations. Ozone has been found effective in removing colors, tastes, odors, cyanides, phenols, and iron ferricyanide from industrial waste waters. Methods of ozone generation and application, and ozonation of potable water were also reviewed. (Lisk-FIRL)  
W78-07444

# A PILOT PLANT STUDY ON ADVANCED TREATMENT OF TREATED SEWAGE FOR REUSE, (IN JAPANESE)

A. Ando, T. Yamada, H. Kimura, and Y. Tamai.  
Journal of Japan Water Works Association, No. 518, p 41-61, November, 1977, 19 fig, 13 tab, 5 ref.

Descriptors: \*Pilot plants, \*Activated carbon, \*Biological treatment, \*Oxidation, \*Filtration, Coagulation, Sedimentation, Chemical precipitation, Separation techniques, Bubbles, Waste water treatment, Municipal wastes.

Pilot studies were conducted in Osaka, Japan, to evaluate advanced techniques of municipal waste water treatment for reuse as potable water. Water supplies for Osaka and several other districts are obtained from the Yodo River. Due to an increasing water demand by these cities, alternative industrial water supplies, such as treated sewage, are being considered. A three-year pilot plant study has investigated the treatment of municipal waste water by bubble separation, coagulation-sedimentation, activated carbon, rapid filtration, and biological oxidation. Operating experiences and the results of the study are presented. (Lisk-FIRL)  
W78-07445

# MAXIMIZING PHOSPHORUS REMOVAL IN ACTIVATED SLUDGE

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.  
W. R. Elliott, J. T. Riding, and J. H. Sherrard.  
Water and Sewage Works, Vol. 125, No. 3, p 88-92, March, 1978, 38 ref.

Descriptors: \*Phosphorus, \*Biological treatment, \*Activated sludge, \*Chemical precipitation, Nutrient removal, Absorption, Biodegradation, Calcium carbonate, Lime, Pilot plants, Laboratory tests, Hardness(Water), Phosphates, Limiting factors, Publications, Waste water treatment, Municipal wastes.

Improving phosphorus removal in activated sludge by microbial growth, excess uptake, and chemical precipitation was discussed in a review of published experimental data and on-site tests in waste water treatment plants. Laboratory data on microbial uptake identified the C:P ratio as a limiting factor in phosphorus removal; the higher COD:P ratio provided more of the stoichiometric requirement. Variations in mean cell residence time affected phosphorus removal, although the average sludge phosphorus content of 2-3% by weight was not significantly improved. Enhanced phosphorus removal was achieved in plug flow reactors with dissolved oxygen control at pH 6; anaerobic conditions were avoided by adequate sludge removal. Batch studies on excess uptake demonstrated that 80% removal occurred for a low phosphate concentration, 5 mg/liter, in the presence of a high microbial population. The presence of Na(+) and K and the rate of aeration were cited as limiting factors in excess phosphorus uptake. In batch studies, E. coli contained 2.4-4.0% phosphorus by dry weight, indicating that nutrient deprivation improved phosphorus uptake. Full-scale studies verified that phosphorus was released into the effluent stream under anaerobic conditions. Precipitation with CaCO<sub>3</sub> resulted in hydrolysis of phosphates at the head of the aeration tank, decreased CO<sub>2</sub> generation, and the formation of calcium phosphate sludge. The optimum conditions, and the formation of calcium phosphate sludge. The optimum conditions for phosphorus removal in a plug flow system were concluded to be: pH 7.5-8.5 less than 350 mg/liter CaCO<sub>3</sub>, and 24 mg/liter Mg(++) . (Lisk-FIRL)  
W78-07446

# THE PRODUCTION OF PROTEIN FROM MUNICIPAL SLUDGE

Utah Univ., Salt Lake City. Dept. of Chemical Engineering.  
E. B. Christiansen, and D. H. Mitchell.  
AIChE Symposium Series, Vol. 74, No. 172, p 175-181, 1978, 7 fig, 2 tab, 33 ref.

Descriptors: \*Activated sludge, \*Proteins, \*Amino acids, \*Nitrogen, \*Centrifugation, Sodium compounds, Organic compounds, Nutrients, Chemical precipitation, Coagulation, Waste water treatment, Municipal wastes.

A laboratory technique combining chemical treatment and centrifugation was developed to extract protein from activated sludge. The activated sludge contained about 4-6 g solids/liter, consisting of 6% nitrogen, 34% protein, and 25% ash. The activated sludge suspension was initially centrifuged and then homogenized with deionized water. Further protein release was accomplished by sodium hydroxide treatment at 25°C for 60 min. Solid waste was removed from the suspension by centrifugation; the protein was then coagulated with dilute sulfuric acid at pH 3.0. After the protein precipitate was centrifuged from the liquid, the solids were heated at 80°C for 12 hr to yield a dry product with 42.4% amino acids. Coagulation of the protein at 25°C produced an amino acid content of 43.5% and at 95°C, a product with 48.5% amino acid. Experiments to reduce the high concentrations of heavy metals in the activated sludge were relatively unsuccessful. Further research on heavy metal removal, especially with hydrochloric acid, was recommended. Cost estimates based on 1976 prices were \$3.95/lb of protein or \$0.17/lb of product for an operation handling 12,000 tons of excess activated sludge containing 34% protein/320 day yr. (Lisk-FIRL)  
W78-07447

# LOS ANGELES FACES SEVERAL SLUDGE MANAGEMENT PROBLEMS

Los Angeles Orange County Metropolitan Whittier, CA.  
E. Davis, and R. T. Haug.  
Water and Wastes Engineering, Vol. 15, No. 4, p 37-40, 42, April, 1978, 2 fig, 2 tab, 7 ref.

Descriptors: \*Treatment facilities, \*Sludge treatment, \*Sludge disposal, \*Regional development, \*Pipelines, Transfer, Oceans, Marine geology, Incineration, Dewatering, Biodegradation, Recycling, California, Waste water treatment, Municipal wastes.

Alternative methods of sludge treatment and disposal were formulated by the Los Angeles/Orange County Metropolitan Area project of California. Four of the eighteen initial treatment alternatives are discussed. The sludge load from Los Angeles, Los Angeles County, and Orange County is expected to reach 1,540 tons/day by 1985, increasing to 1,785 tons/day by 2020. Long distance transport, a composting-sludge recycle station, thermal processing, and ocean disposal are being considered for sludge disposal. Land application of digested liquid sludge and composted digested sludge would require 80,000 or 30,000 acres, respectively, at agricultural application rates. Sludge would have to be transported to suitable land areas 70-100 miles away or be pumped through a pipeline with pumping lifts. Mechanical dewatering and composting of sludge fully recovers the fertilizer value, providing high cakes solids are produced; acreage and location requirements still pose a problem. A sludge-refuse mixture can be thermally processed at the individual treatment facilities, producing sufficient energy to operate the reactor and other treatment facilities. Ocean disposal of sludge can now be performed to a depth of 3,000 ft in basins rather than the current 300 ft depth limit, but additional environmental impact studies are required. (Lisk-FIRL)  
W78-07448

# PLANTS AND SYSTEMS FOR COMPOSTING OF SEWAGE SLUDGES IN THE FEDERAL REPUBLIC OF GERMANY--STATE OF THE ART AND TRENDS (ANLAGEN UND SYSTEME ZUR KOMPOSTIERUNG VON ABWASSERSCHLAEMMEN IN DER BUNDESREPUBLIK DEUTSCHLAND--STAND SOWIE TENDENZEN)

Unweltbundesamt, Berlin (West Germany).  
For primary bibliographic entry see Field 5F.  
W78-07449

# NITRIFICATION SYSTEMS WITH INTEGRATED PHOSPHORUS PRECIPITATION

Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.  
P. M. Sutton, K. L. Murphy, and B. E. Jank.  
Water and Pollution Control, Vol. 116, No. 4, p 27-33, April, 1978, 6 fig, 2 tab.

Descriptors: \*Nitrification, \*Nutrient removal, \*Phosphorus, \*Chemical precipitation, \*Pilot plants, Coagulation, Sludge treatment, Nitrification, Biological treatment, Alkalinity, Calcium carbonate, Waste water treatment, Municipal wastes.

Design criteria for nitrifying activated sludge systems with integrated phosphorus precipitation were developed in pilot studies with combined and separate systems. The pilot plants included a two-stage separate sludge system with two 480 Imperial gal aeration tanks and a two-stage combined sludge system having by-passable intermediate clarification and two aeration tanks. The latter unit operated as a separate sludge system when the clarifier returned sludge to the initial aeration tank. Alum or ferric chloride were added to the separate and combined systems in a precipitant-influent phosphorus ratio of 1.0-2.0 with a dissolved ox-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

oxygen concentration maintained at or above 2.0 mg/liter. Biological equilibrium was maintained with a solids retention time of 8-10 days. Biological equilibrium was maintained with a solids retention time of 8-10 days. The effect of chemical addition at 15 mg/liter on nitrification was insignificant as measured by the amount of filterable total Kjeldahl nitrogen (TKN) in both systems. Both systems generated comparable quantities on nitrate. The geometric mean value of total filterable phosphorus in the precipitant-treated effluent from both plants was 0.35 mg/liter, compared to 2.1 mg/liter in the untreated system. Alkalinity consumption as  $\text{CaCO}_3$  was 8.0 g/g filterable TKN in the chemically-treated system and 6.0 g/g filterable TKN in the system without chemical precipitation. An additional 1.23 kg of solids was generated in the chemically treated systems. The nitrification rate in the combined and separate sludge systems was determined to be a function of temperature. (Lisk-FIRL)

W78-07450

#### AIR VS O<sub>2</sub>: TWO ACTIVATED SLUDGE SYSTEMS COMPARED,

Union Carbide Corp., Tonawanda, NY. Environmental Systems Dept. M. A. Miller.

Water and Wastes Engineering, Vol. 15, No. 4, p 58-60, 62-65, April, 1978. 6 fig, 8 tab, 17 ref.

Descriptors: \*Activated sludge, \*Aeration, \*Oxygen, \*Flocculation, \*Sludge treatment, \*Dewatering, Biomass, Biological treatment, Operation and maintenance, Waste water treatment, Municipal wastes.

Pure oxygen activated sludge systems and air activated sludge treatment of waste water are compared with respect to differences in sludge quality, production, and dewatering, energy input, and economics of the two systems. Air activated sludge systems operate at a dissolved oxygen concentration of 0.5-2.0 mg/liter; the dissolved oxygen range for the pure oxygen system is 5-8 mg/liter. The higher dissolved oxygen concentration improves oxygen diffusion through the biofilm particles, thus supplying adequate oxygen to the organisms in the biomass. The large supply of oxygen promotes endogenous activity in the biomass and, in theory, the production of exocellular biopolymer and rounded biofilm particles which settle readily and are easily dewatered. High dissolved oxygen concentrations are thought to limit the predominance of filamentous organisms over spherical organisms. Air activated sludge systems have a higher volumetric oxygen demand and require a larger and more efficient aeration tank than pure oxygen sludge systems. Pilot scale systems have demonstrated that oxygen increases sludge settling rates to about 2.5 times faster than in air systems. Higher dissolved oxygen levels promote endogenous respiration in the microorganisms which convert more biomass to carbon dioxide, thereby reducing excess sludge production. The production of exocellular biopolymers contributes to the shape and formation of the biological floc and improves dewatering of the sludge. Operation and maintenance costs for the pure oxygen system are about 20% lower than costs for air systems. (Lisk-FIRL)

W78-07451

#### LAWTON ADVANCED WASTEWATER TREATMENT PLANT,

J. M. Baker. The Military Engineer, Vol. 70, No. 454, p 78-81, March-April, 1978. 2 fig.

Descriptors: \*Treatment facilities, \*Tertiary treatment, \*Phosphorus, \*Nitrogen, \*Nutrient removal, Biochemical oxygen demand, Nitrification, Lime, Chemical precipitation, Coagulation, Sludge disposal, Incineration, Waste water treatment, Municipal wastes.

The municipal waste water treatment plant recently completed for Lawton, Oklahoma, provides separate sections for primary, secondary, and tertiary treatment to remove high phosphorus and nitrogen concentrations from the raw sewage. The plant has a capacity of 10 mgd with a potential capacity of 13.3-30 mgd with a 15 million gal holding tank for waste storage during overflow conditions. The influent contains: 253 mg/liter BOD, 561 mg/liter COD, 241 mg/liter suspended solids, 28 mg/liter total nitrogen, and 18 mg/liter total phosphorus. Primary treatment consists of screening, degritting, preaeration, and primary clarification. The two-stage secondary treatment process combines circulation of waste water through trickling filters and polyvinyl chloride packed-media towers, followed by nitrification. The nitrification process includes batch aeration and flash mixing of the effluent with lime to maintain alkalinity. Sludge is removed in the tertiary treatment section is accomplished by lime precipitation, with alum and polymer as supplements. The waste water is treated with alum in flash mixers and is then flocculated and settled. This procedure is followed by a two-stage recarbonation with intermediate clarification. Sludge is incinerated, returned to the flash mixers, or wasted in a gravity thickener followed by storage and drying. The final effluent is chlorinated and filtered through sand-anthracite beds. The treated waste water has a BOD of 3 mg/liter, a total phosphorus content of less than 1.0 mg/liter, a nitrate-nitrogen level of 15 mg/liter, and no coliforms. (Lisk-FIRL)

W78-07452

#### CHLORINE DETECTOR SAVES A LIFE.

For primary bibliographic entry see Field 5A. W78-07453

#### GAS MONITORS FOR SEWAGE TREATMENT WORKS.

For primary bibliographic entry see Field 5A. W78-07454

#### STERIC HINDERANCE ON COMPETITIVE INTERACTION IN ACTIVATED CARBON ADSORPTION FROM BI-SOLUTE SOLUTION OF PHENOL AND ORGANICS IN BIOLOGICAL TREATED SEWAGE, (IN JAPANESE),

N. Tambo, and K. Fukushi. Journal of Japan Water Works Association, No. 518, p 28-40, November, 1977. 23 fig, 8 ref.

Descriptors: \*Activated carbon, \*Mathematical models, \*Analytical techniques, \*Phenols, \*Adsorption, Organic wastes, Equilibrium, Laboratory tests, Waste water treatment, Municipal wastes.

Mathematical models were developed for calculating the competitive adsorption onto activated carbon in a bi-solute solution containing phenol and organic materials in biologically treated waste water. The mathematical models, adapted from Langmuir's bi-solute adsorption equations, incorporated the effects of spatial limitations on the adsorption of phenol caused by sewage molecules occupying available sites. The equations accurately predicted the deterioration of the adsorbed phenol equilibrium in response to competition with organic materials for activated carbon adsorption. A method for calculating the equilibrium deterioration rate was also developed using the comparative molecular size of the bi-solute molecules. Experiments were conducted to verify the accuracy of the deterioration rate predictions. (Lisk-FIRL)

W78-07455

#### PH AVERAGING,

State Univ. of New York at Buffalo. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5A. W78-07456

#### EFFECT OF THERMAL PRETREATMENT ON DIGESTIBILITY AND DEWATERABILITY OF ORGANIC SLUDGES,

Los Angeles Orange County Metropolitan Area, Whittier, CA.

R. T. Haug, D. C. Stuckey, J. M. Gossett, and P. L. McCarty.

Journal Water Pollution Control Federation, Vol. 50, No. 1, p 73-85, January, 1978. 6 fig, 4 tab, 11 ref.

Descriptors: \*Heat transfer, \*Thermal radiation, \*Sludge treatment, \*Dewatering, \*Biodegradation, Anaerobic conditions, Activated sludge, Biological treatment, Sludge digestion, Suspended solids, Methane, Gases, Waste water treatment, Municipal wastes.

Thermal pretreatment of organic sludges increased the biodegradability and improved the methane gas production of activated sludge. Digested, primary, flotation-thickened, and activated sludges were treated at 175°C for 30 min in laboratory pressure reactors followed by anaerobic digesters. Thermal pretreatment of activated sludge increased the methane production by 60% and decreased volatile suspended solids by 36%. In primary sludge, volatile suspended solids and COD were reduced by more than 60% but gas generation did not significantly increase. Methane gas production increased by 14% after thermal pretreatment of a mixture of primary and activated sludge; volatile suspended solids levels decreased by 16%. Thermal pretreatment of waste activated sludge at temperatures up to 175°C improved the biodegradability and gas production of the sludge. Treatment at 200°C and 225°C of basic activated sludge adversely affected the sludge properties and gas generation. After thermal pretreatment, residual heat in the sludge was sufficient for digestion without supplementary fuel being required. Odors were reduced during anaerobic digestion after thermal pretreatment. (Lisk-FIRL)

W78-07457

#### MEDICALLY USED RADIONUCLIDES IN SEWAGE SLUDGE,

Lund Univ. (Sweden); and Lund Inst. of Tech. (Sweden). Dept. of Nuclear Physics.

For primary bibliographic entry see Field 5A. W78-07460

#### THE BEHAVIOR OF F2 COLIPHAGE IN ACTIVATED SLUDGE TREATMENT,

Surrey Univ., Guildford (England). S. A. Balluz, M. Butler, and H. H. Jones. Cambridge Journal of Hygiene, Vol. 80, No. 2, p 237-242, 1978. 1 fig, 1 tab, 12 ref.

Descriptors: \*Viruses, \*Bacteriophage, \*Activated sludge, \*Influent streams, \*Effluent streams, Biocontrol, \*Biological treatment, Diseases, Water pollution sources, Waste water treatment, Municipal wastes.

Influent, effluent, and mixed liquor from a model activated sludge plant were inoculated with f2 coliphage and monitored for 5 days. Titers of the bacteriophage increased rapidly in the mixed liquor and the effluent, reaching a plateau after about 20 hrs. Titers of the virus from the liquid and solid portions of the mixed liquor before inoculation indicated that a higher percentage of the bacteriophage was contained in the solids fraction. After inoculation, 84% of the total titer was contained in the liquid fraction. After inoculation ceased, the solids portion had the higher 64% virus content. The f2 coliphage concentration in the effluent during inoculation was about 20.4% of that in the influent, indicating 79.6% removal by the model activated sludge plant. When the influent settled sewage was replaced with raw sewage, plant efficiency dropped to 26.3% during inoculation. A comparison of the titers of f2 coliphage with data from a previous study using poliovirus showed that poliovirus was concentrated in the

solids portion of the mixed liquor during inoculation; the removal rate of the poliovirus by the model plant was 99.96%. The f2 coliphage was not considered an appropriate model for studies of human enteroviruses. (Lisk-FIRL)  
W78-07461

**MEASURING PETROLEUM HYDROCARBONS IN DIGESTED SEWAGE SLUDGES,**  
Canada Centre for Inland Waters, Burlington (Ontario).  
For primary bibliographic entry see Field 5A.  
W78-07462

**CONCENTRATION OF ENTEROVIRUSES FROM LARGE VOLUMES OF TAP WATER, TREATED SEWAGE, AND SEAWATER,**  
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.  
For primary bibliographic entry see Field 5F.  
W78-07463

**NEW PROCEDURE DETERMINES AEROBIC SLUDGE STABILITY,**  
Virginia Univ., Charlottesville. Dept. of Civil Engineering.  
R. B. Hartman, E. R. Bennet, K. D. Linstedt, and D. G. Smith.  
Water and Sewage Works, Vol. 125, No. 4, p 42-44, April, 1978, 2 fig, 16 ref.

Descriptors: \*Stability, \*Hydrogen sulfide, \*Sewage bacteria, \*Bioindicators, \*Analytical techniques, Sludge digestion, Laboratory tests, Solid wastes, Oxygen demand, Waste water treatment, Municipal wastes, Aerobic digestion, \*Aerobic digester performance.

The stability of aerobically digested sludge was measured by a modified lead acetate strip procedure which provided a stability index from hydrogen sulfide production by *Desulfovibrio* bacteria. Conventional means of stability determination by total and volatile solids reduction were considered inadequate because of the influence of sludge composition and age. The specific oxygen uptake rate method of stability calculation was rejected because of its dependence upon digestion reactor environment, temperature, and sludge age. The lead acetate strip test was modified from a method introduced by Ruffer. A 10 ml sample of digested sludge was placed in a 6-inch test tube containing a strip of lead acetate paper. The tube was stoppered and incubated at 37°C until the test paper turned brown or black, indicating hydrogen sulfide generation. The stability index was defined as the duration of the incubation period. The procedure was applicable to both drained and undrained sludge samples. The method provided closer contact of the lead acetate strip with hydrogen sulfide, a more favorable temperature for *Desulfovibrio* bacteria, and a minimum sample size requirement. (Lisk-FIRL)  
W78-07464

**PHOSPHORUS REMOVAL BY PRECIPITATION WITH FE (III),**  
Montgomery (James M.) Inc., Walnut Creek, CA.  
M. C. Kavanaugh, V. Krejci, T. Weber, J. Eugster, and P. V. Roberts.  
Journal Water Pollution Control Federation, Vol. 50, No. 2, p 216-233, February, 1978, 10 fig, 6 tab, 46 ref.

Descriptors: \*Phosphorus, \*Iron, \*Chemical precipitation, \*Model studies, \*Coagulation, Nutrient removal, Separation techniques, Sludge treatment, Statistical models, Pilot plants, Waste water treatment.

Waste water from Zurich, Switzerland, was used in pilot plant studies on phosphorus removal from biologically treated waste water with ferric under post precipitation conditions. Statistical models of

ferric precipitation, shear flocculation, and filtration of suspended solids removal in the sludge blanket clarifier were developed. The performance controlling variables examined during physical-chemical treatment were pH, initial mixing, surface loading rates in the sludge blanket clarifier, the ferric/total phosphorus mole ratio, hydraulic residence time, and flocculation mixing intensity. Initial mixing in the 1.4 cu m/hr flow pilot plant was not an important factor. At pH 8.8, a significant amount of total phosphorus was removed. The reduction of soluble phosphorus, total phosphorus, and total organic carbon was significantly improved by increasing the ferric/total phosphorus mole ratio. Solids-liquid separation was the most significant factor influencing system performance. Surface loading controlled the solids removal from the sludge blanket clarifier. The models agreed significantly with observations and could be effective in evaluating other phosphorus removal techniques. (Lisk-FIRL)  
W78-07465

**CLINOPTILOLITE COLUMN AMMONIA REMOVAL MODEL,**  
Minnesota Univ. Minneapolis. Dept. of Civil and Mineral Engineering.  
M. J. Semmens, A. C. Booth, and G. W. Tauxe.  
Journal of the Environmental Engineering Division-ASCE, Vol. 104, No. EE2, p 231-244, April, 1978, 11 fig, 2 tab, 20 ref.

Descriptors: \*Ammonium compounds, \*Zeolites, \*Iron exchange, \*Model studies, \*Analytical techniques, Ammonia, Isotherms, Graphical analysis, Mathematical studies, Waste water treatment, Nutrient removal, Municipal wastes.

Performance models were developed for the removal of ammonium by a column of clinoptilolite, a zeolite consisting of an aggregate of crystallites cemented together by quartz, feldspar, unaltered glass, and other impurities. Synthetic secondary effluent containing 95 mg Na, 21 mg Ca, 18 mg Mg, 6.5 mg K, and 358 mg alkalinity per liter at pH 8.0-8.5 was passed through a column packed with clinoptilolite that had been conditioned with sodium chloride, ammonium sulfate, and hydrochloric acid. In batch isotherm measurements, 0.05-80 gram aliquots of clinoptilolite were equilibrated in the synthetic waste water with ammonium additions of 10, 20, 40, and 50 mg/liter. The batch isotherms and breakthrough curves for clinoptilolite yielded a linear plot which was described by the Langmuir model. The ammonium capacities predicted according to batch isotherms were higher than those observed in actual column tests. An accumulation model, estimated by a finite difference technique, adequately predicted breakthrough curves under conditions of varying flow rate, ammonium concentrations, bed depth, and particle size. Batch isotherms accurately predicted ammonium removal by the column when the clinoptilolite was completely regenerated. In the case of incomplete regeneration, breakthrough curves for different ammonium concentrations were needed to accurately predict column performance. (Lisk-FIRL)  
W78-07466

**DEVELOPMENTS IN PERFORMANCE RELATIONSHIPS FOR SEWAGE,**  
Birmingham Univ., (England). Dept. of Civil Engineering.  
T. H. Y. Tebbutt.  
Public Health Engineer, Vol. 6, No. 2, p 79-85, 1978, 9 fig, 21 ref.

Descriptors: \*Mathematical models, \*Activated sludge, \*Settling basins, Optimization, \*Analytical techniques, Model studies, Sludge treatment, Pilot plants, Theoretical analysis, Data collections, Waste water treatment, Municipal wastes, \*Performance.

Performance relationships based on operating conditions in pilot-scale primary sedimentation and activated sludge units are utilized to develop optimization models for sewage treatment plants. The performance relationships may be established by developing a theoretical model based on the nature of the treatment process and the principles of its operation or by formulating an empirical model to depict the mathematical or graphical relationships of observed performance. Performance data should be obtained with pilot-scale systems. The performance relationships in primary sedimentation are derived as a function of suspended solids removal efficiency, surface overflow rates, retention time, and various effluent characteristics. The organic removal rate in the activated sludge process is expressed as a function of the concentration of the organic matter, active biological solids, and time. The suspended solids removal efficiency of the final sedimentation tank is calculated with a model incorporating surface overflow rate, mixed liquor suspended solids, and time; it does not require data on the properties of the suspended solids. Performance relationships in the production and treatment of sludge are based on primary sedimentation performance. In the case of activated sludge units, they are represented as a function of solids accumulation, endogenous respiration, nonbiodegradable solids, and volatile solids in the influent and effluent. The performance relationships can be used to evaluate treatment plant designs on a least-cost basis. (Lisk-FIRL)  
W78-07467

**MODEL TESTS OF CIRCULAR SEWAGE SEDIMENTATION TANKS,**  
Edinburgh Univ. (Scotland). Dept. of Civil Engineering.

I. F. Christie, and R. W. Harbison.  
Proceedings of the Institution of Civil Engineers (London), Vol. 65, Part 2, p 71-84, March, 1978, 6 fig, 3 tab, 29 ref.

Descriptors: \*Settling basins, \*Intakes, \*Baffles, \*Sedimentation, \*Sewage, Sludge, Screens, Suspended solids, Model studies, Structural models, Hydraulic models, Waste water treatment, Municipal wastes.

Model studies of circular sewage sedimentation tanks were performed with quiescent columns of screened sewage and in model circular sedimentation tanks with deep cylindrical inlet baffles. The quiescent column tests with screened sewage yielded suspended solids reductions of 35% and 60% for initial suspended solids concentrations of 250 mg/liter and 600 mg/liter, respectively. Suspended solids in composite sewage were reduced by 50% in the quiescent column tests. Flow pattern and sludge distribution analyses in circular sedimentation tanks indicated that four horizontal inlet plates with wide spacing produced the most uniform sludge distribution. Sludge deposition near the inlet was prevented in similar studies with a cylindrical inlet baffle. A comparison of the two inlet types in model sedimentation tanks receiving a flow of 35 cu m/sq m/day demonstrated that the cylindrical baffle, which reduced suspended solids by 31%, was more efficient than the horizontal plates, which reduced solids by 20-21%. These results indicated that detention time in the tank, rather than equal surface rating scaling, was the important factor in predicting full-scale tank performance. (Lisk-FIRL)  
W78-07468

**RECYCLING OF WATER FOR IRRIGATION: PERSISTENCE OF ENTEROVIRUSES IN SEWAGE EFFLUENT AND NATURAL WATERS RECEIVING THE EFFLUENT,**  
Hawaii Univ., Honolulu. Water Resources Research Center.  
For primary bibliographic entry see Field 5B.  
W78-07471



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

#### SUBMISSION BY THE INSTITUTE OF WATER POLLUTION CONTROL TO THE ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION ON 'ENVIRONMENTAL POLLUTION AND AGRICULTURE'.

For primary bibliographic entry see Field 5B.  
W78-07473

#### FUTURE TREATMENT PLANT REQUIREMENTS.

Durban City Engineers Dept. (South Africa).  
D. C. Macleod.

Water Pollution Control, Vol. 77, No. 1, p 20-24, 1978.

Descriptors: \*Water supply development, \*Reclaimed water, \*Water utilization, \*Tertiary treatment, Water sources, Industrial wastes, River basins, Waste water disposal, Waste water treatment, Municipal wastes, Nutrient removal.

Supplementation of South Africa's potable water resources with treated municipal and industrial wastes is considered. Protection of river catchments which provide potential water supplies is recommended to prevent pollution by waste discharges. Waste water which contains difficult to treat but environmentally safe substances can be discharged to catchments which are not potential water sources. To maintain the quality of inland waters, tertiary treatment must be included in future waste water treatment plants; algal growth potential must be controlled below 25 mg/liter by nutrient removal. Nitrogen and phosphorus removal from waste waters is an important consideration in preventing algal blooms which clog filters in waste water treatment facilities. Landfill leachates and heavy metals from industries, domestic and municipal wastes should be controlled at the source before pollutants accumulate in the water supplies. Suspended solids and virus reductions can be achieved through natural self-purification in water bodies by locating waste discharge points a proper distance from the water supply. Disinfection by ozonation, chlorination, and other chemical treatments needs to be further investigated in relation to future water supplies. (Lisk-FIRL)  
W78-07474

#### LANDMARK TEXAS DECISION AGREES BENEFIT IS NOT WORTH THE COST.

Dallas Water Utilities Dept., TX.  
For primary bibliographic entry see Field 5G.  
W78-07475

#### CONSERVE ENERGY IN WASTEWATER SYSTEMS.

Black and Veatch, Detroit, MI.  
W. F. Foster.  
Water and Wastes Engineering, Vol. 15, No. 4, p 20-23, April, 1978.

Descriptors: \*Energy, \*Efficiencies, \*Fossil fuels, \*Electric power, \*Anaerobic digestion, Oxidation lagoons, Lime, Polymers, Optimization, Sludge treatment, Sludge disposal, Waste water treatment, Design data, Municipal wastes.

Recommendations for the energy-efficient design of waste water treatment facilities are presented. Alternatives to direct firing of fossil fuels are electricity, solar energy, and heat pump recovery techniques. Oxidation ponds, fixed media filtration, anaerobic digestion, and land application of sludge require less energy than other treatment methods. Constant capacity pumps are more efficient than variable speed units; continuous flow requires less energy for warm-up or idle than intermittent operation. Mixing of primary anaerobic digesters is more efficient and the greater volume of gas produced can be stored for use in internal combustion equipment. Limiting the chemical doses of lime, ferric chloride, or polymer in sludge conditioning and designing efficient conditioning

tanks can improve the properties of the sludge for later disposal. The reduction of dissolved oxygen levels in activated sludge and nitrification systems, excess air in the energy requirements. Energy efficiency can be maintained in treatment buildings by reducing ventilation, temperature, and light, in non-critical areas, and by providing an elevated tank for the plant water system. Further energy savings can be attained by recovering all heat sources in plant operation. (Lisk-FIRL)  
W78-07476

#### THE DESIGN AND CONSTRUCTION OF THE MARTHOLME REGIONAL SEWAGE-TREATMENT WORKS.

P. D. Roberts, D. Chadwick, and D. Richardson.  
Water Pollution Control, Vol. 76, No. 4, p 493-504, 1977. 4 fig, 3 tab, 1 ref.

Descriptors: \*Regional development, \*Activated sludge, \*Screens, \*Settling basins, \*Treatment facilities, Biochemical oxygen demand, Suspended solids, Aeration, Sludge treatment, Sludge disposal, Pumping, Waste water treatment, Municipal wastes.

The design of the Martholme Regional waste water treatment facility in England, under the jurisdiction of the North West Authority, is described. Waste water from the Calder River valley is pumped to the regional facility; Hyndburn River valley wastes are transported by gravity flow. The plant has a 1991 design dry weather flow capacity of 74,880 cu m and a full flow capacity of 175,300 cu m. The flow to the plant by 2011 is estimated as 101,550 cu m dry weather flow and 237,730 cu m full flow. The raw sewage flow to the regional facility has an average BOD load of 283 mg/liter and a suspended solids content of 162 mg/liter. Treatment at Martholme includes initial screening and dewatering, storm water separation, primary sedimentation, aeration, secondary settlement, and activated sludge return. Methods of sludge disposal, such as digestion and land disposal, dewatering and landfill disposal, and incineration, are being considered. (Lisk-FIRL)  
W78-07477

#### NIGHT SOIL TREATMENT BY 'DENIPAC PROCESS'-KAWAMUKO TREATMENT PLANT, MATSUE CITY (2), (DENIPAKU PU-RROSSU NI YORU SHINYO SHORI-MATSUE SHI KAWAMUKO SHORJO),

Y. Ichiki.  
Ebara Infuruko Jiho, (Ebara-Inflico Review), No. 71, p 15-19, October, 1977. 5 fig, 5 tab.

Descriptors: \*Domestic wastes, \*Nitrogen, \*Phosphorus, \*Treatment facilities, \*Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Eutrophication, Nutrient removal, Waste water treatment, Municipal wastes, \*Night soil treatment.

The patented Ebara-Inflico Denipac process was implemented in 1976 at the Kawamuko Treatment Plant in Matsue City, Japan. The Denipac process removes suspended solids and BOD from domestic wastes treated in the plant. Effective phosphorus and nitrogen removal has been achieved, resulting in high quality effluent and less risk of eutrophication in water bodies. The Denipac process has produced consistent results independent of load variations and waste density. The effluent from the sedimentation has a BOD and suspended solids concentration of 14 ppm, despite a primary dilution rate two to three times lower. High removal rates have been observed for COD due to manganese, BOD, suspended solids, and total nitrogen. (Lisk-FIRL)  
W78-07478

#### PVC PIPE PASSES PERFORMANCE AND COST TESTS.

Certain-Teed Corp, Valley Forge, PA. Pipe and Plastics Group.

For primary bibliographic entry see Field 8G.  
W78-07479

#### NATURAL SEWAGE RECYCLING SYSTEMS

Brookhaven Nation Lab., Upton, NY. Dept. of Applied Science.  
M. M. Small.  
Available from the National Technical Information Service, Springfield, VA 22161 as BNL-50630. Price codes: A03 in paper copy, A01 in microfiche. Report BNL-50630, January 1977, 40 p, 17 fig, 17 ref.

Descriptors: \*Marshes, \*Ponds, \*Aeration, \*Deciduous forests, \*Artificial recharge, Return flow, Waste assimilative capacity, Filtration, Biochemical oxygen demand, Nitrogen, Nutrient removal, Aerated lagoons, Waste water treatment, Municipal wastes.

Natural purification of municipal waste waters was evaluated in experiments with marsh-pond systems at the Brookhaven National Laboratory in Upton, New York. Observations under identical conditions indicated that a marsh-pond system but required about half the land area. Raw sewage mixed with septage was pretreated with dewatering and aeration before application. The design of a marsh-pond sewage treatment system for a pollution of 2,500 and a waste flow of .25 mgd utilized a BOD curve to predict final effluent quality. A 24 hr aeration period reduced the initial 210 ppm BOD by 50%. A retention time of 18 days in the marsh further reduced the BOD to less than 30 ppm. Recharge of the waste water through a pine and deciduous forest floor produced a BOD of 5-15 ppm, resulting in a 98% BOD removal. Total nitrogen removal by the marsh-pond method with forest recharge was 87.5%. Costs for a marsh-pond treatment system of this scale, without land purchase costs or interest, were estimated to be \$1/gal/day for initial expenses and \$0.50/1,000 gal operation and maintenance. (Lisk-FIRL)  
W78-07515

#### INDEPENDENT PHYSICAL-CHEMICAL TREATMENT OF RAW SEWAGE,

Los Angeles County Sanitation Districts, Whittier, CA.

L. S. Directo, C-L. Chen, and R. P. Miele.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 514. Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-137, August 1977. 119 p, 3 fig, 21 tab, 15 ref.

Descriptors: \*Activated carbon, \*Coagulation, \*Alum, \*Polymers, \*Pilot plants, Sulfides, Sodium compounds, Nitrates, Chemical oxygen demand, Suspended solids, Metals, Waste water treatment, Municipal wastes.

Independent physical-chemical treatment of raw sewage with alum and polymer clarification and activated carbon filtration and adsorption was studied at a 50 gpm pilot plant in Pomona, California. The independent physical-chemical process was evaluated as an alternative to biological treatment of raw sewage. The effluent was initially clarified with 25 mg alum/liter and 0.3 mg anionic polymer/liter. Activated carbon adsorption was conducted in a column with a hydraulic loading of 4 gpm/sq ft and a contact time of 30 min. The process reduced COD by 94% suspended solids by 96.6%, and total phosphate by 92%. Additions of 5.4 mg sodium nitrate/liter N to the carbon column were preferred over chlorination and oxygenation to prevent sulfide generation in the activated carbon. Nitrate additions enhanced biologic activity and allowed high organic loading of the column, removing 3.54 kg total COD/kg carbon and 1.54 kg dissolved COD/kg carbon. Metals removed from the waste water by activated carbon were evident in dust produced during thermal regeneration of the carbon, including: Ca, Cd, Cu, Cr, Al, Fe, Sn, Pb, Ni, and Zn. The estimated cost for a 10 mgd in-

dependent ph  
initial clarifi  
\$0.0869/sq m  
W78-07516

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Descriptors:  
\*Hydrolysis,  
demand, B  
Lipids, Ca  
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Descriptors:  
\*Sands, \*L  
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# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Waste Treatment Processes—Group 5D

dependent physical-chemical treatment, including initial clarification and carbon regeneration, was 50.069/sq m of effluent. (Lisk-FIRL)  
W78-07516

**SOLUBILIZATION OF ORGANIC CARBON DURING THE ACID PHASE OF ANAEROBIC DIGESTION.**  
Washington Univ., Seattle.  
J.A. Eastman.  
Available from University Microfilms International, Ann Arbor, MI 48106; Order No. 78 00920. PhD Thesis, 1977.

Descriptors: \*Carbon, \*Anaerobic digestion, \*Hydrolysis, \*Denitrification, \*Chemical oxygen demand, Biodegradation, Methane, Nitrogen, Lipids, Carbohydrates, Cellulose, Analytical techniques, Waste water treatment, Sludge, Municipal wastes.

Soluble organic carbon produced during the acid phase of anaerobic digestion was evaluated as a substrate replacement in biological denitrification. A surrogate substrate containing dry dog food and cellulose at 25-35 C and pH 3.6-6.7 and primary sludge at 35C and pH 5.1-6.7 were mixed separately in digestors operated with detention times of 9, 18, 36, and 72 hrs. The hydrolysis of particulate matter, rather than acid fermentation, was found to be the rate-limiting stage in the acid phase of digestion. Of the degradable materials in the surrogate substrate, starch was the most readily utilized, followed by nitrogenous matter; cellulose was used most slowly. For primary domestic sludge, carbohydrate degradation was 70% compared to 55% utilization of nitrogenous materials. Lipids were not utilized in the acid phase; methane generation was less than 10% of the COD. The temperature during dog food substrate digestion could more than double the rate of hydrolysis; solubilization increased with pH and detention time but was unaffected by initial volatile solids concentration. Acid phase steady state models for hydrolysis, bacterial growth, and product formation were formulated with first order functions, Monod's equation, and the COD balance, respectively. Up to 50% of the nonlipid COD was solubilized during the acid phase, indicating that organic carbon was a suitable substrate replacement during denitrification. (Lisk-FIRL)  
W78-07518

**RECLAMATION OF WASTEWATER BY APPLICATION ON LAND.**  
Cold Regions Research and Engineering Lab., Hanover, NH.  
I.K. Iskandar, and D.C. Leggett.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A026 050. Price codes: A02 in paper copy, A01 in microfiche. 1976. 15 p, 5 fig, 2 tab, 23 ref.

Descriptors: \*Infiltration, \*Irrigation practices, \*Sands, \*Loam, \*Silt, Return flow, Waste water disposal, Sewage effluents, Sewage disposal, Heavy metals, Nitrates, Ammonium compounds, Phosphorus, Biochemical oxygen demand, Nitrogen, Sampling, Waste water treatment, Municipal wastes.

Slow infiltration land application of primary and secondary waste water effluents to areas of sandy loam and silt loams was tested over a two-year period. The primary effluent contained 101 mg/liter BOD, 22.1 mg/liter ammonium-nitrogen, 0.6 mg/liter nitrate-nitrogen, 26.4 mg/liter total nitrogen, and 7.0 mg/liter total phosphorus. The secondary effluent contained 35 mg/liter BOD, 21.6 mg/liter ammonium-nitrogen, 2.4 mg/liter nitrate-nitrogen, 26.9 mg/liter total nitrogen, and 7.1 mg/liter total phosphorus. Copper, zinc, chromium, nickel, lead, and mercury were added to simulate heavy metal concentrations in industrial wastes. Effluent was applied to six test cells by slow infiltration at rates of 5, 7.5, and 15 cm/wk.

Percolates obtained from the test cells indicated that BOD was reduced to 0.6-2.1 mg/liter, ammonium-nitrogen lowered to 0.2-9 mg/liter, nitrate-nitrogen increased to 7.2-14.5 mg/liter, total nitrogen decreased to 8.1-16.3 mg/liter, and total phosphorus reduced to less than 0.5 mg/liter. Nearly all of the ammonium-nitrogen in the upper 45 cm of the test cells was converted to nitrate-nitrogen. Increases in total and extractable heavy metals were found in the soil and vegetation in the top 15 cm of the test cells. Extractable copper, cadmium, and nickel increased significantly with spiked sample application, especially in the silt loam test cells. The levels of these extractable metals were considered toxic. (Lisk-FIRL)  
W78-07519

**CAPACITY PLANNING FOR REGIONAL WASTEWATER TREATMENT SYSTEMS.**  
Worcester Polytechnic Inst., MA. Dept. of Civil Engineering.  
L. A. Rossman.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 554. Price codes: A07 in paper copy, A01 in microfiche. Report No. WPI/CE-77/1, April 1977. 141 p, 17 fig, 12 tab, 33 ref, 1 append.

Descriptors: \*Optimization, \*Computer programs, \*Mathematical models, \*Algorithms, \*Treatment facilities, Cost analysis, Cost-benefit analysis, Pipelines, Waste water treatment, Municipal wastes, Analytical techniques.

A computerized economic optimization model is developed for the preliminary design of a regional waste water facility to provide cost effective sites and service alternatives and capacity expansion schedules. A three phase heuristic procedure for solving the optimization model utilizes dynamic programming to minimize combined cost solutions and optimize waste flows; site locations are evaluated in terms of treatment options. The model incorporates design variations in pipeline connections between waste sources and treatment facilities; excess capacity in existing systems is also considered. Accommodations are also made for discount and inflation rates, pipeline costs for preliminary design limits, and treatment facility improvement costs. Application of the optimization model and a mixed integer program to a large scale problem results in similar solutions. The heuristic solution has the advantage of computation speed and accuracy over nonlinear cost or time periods. The model's flexibility allows for alternative objectives other than cost efficiency when parameters and limitations are changed. (Lisk-FIRL)  
W78-07521

**WATER/WASTEWATER SURVEY GUIDELINES.**  
Construction Engineering Research Lab. (Army), Champaign, IL.  
For primary bibliographic entry see Field 5A.  
W78-07522

**ALABAMA, (STATE CAPITAL NEWS),**  
Water and Sewage Works, Vol. 124, No. 9, p 20, September, 1977.

Descriptors: \*Sewerage, \*Government finance, \*Financing, \*Costs, \*Treatment facilities, Alabama, Municipal wastes, Waste water treatment.

Approximately \$150 million has been appropriated by the state of Alabama and the federal government for municipal waste water treatment programs throughout the state. Individual cities receiving funds for improvements on waste water disposal systems will provide 75% of the necessary monies. Federal funds will be used to upgrade the primary level treatment plant at Bay Minette to secondary status. A pollution abatement program

directed by the Jefferson County Commission will be used to clean up Patton Creek, with additions to the Valley Creek plant and construction of an intercepter system for the upper portion of the area serviced by the facility. The secondary treatment plant at Decatur will be replaced and a new plant will be constructed at Huntsville. Additional projects designated for partial federal funding are described. (Schulz-FIRL)  
W78-07523

**VIRION AGGREGATION AND DISINFECTION OF WATER VIRUSES BY BROMINE.**  
North Carolina Univ. at Chapel Hill. Dept. of Bacteriology.  
For primary bibliographic entry see Field 5F.  
W78-07524

**INSTRUMENTATION AND AUTOMATION IN WATER AND WASTEWATER TREATMENT.**  
Philips Environmental Protection, Eindhoven (Netherlands).  
For primary bibliographic entry see Field 5A.  
W78-07525

**THE DEVELOPMENT OF A HYDROPERM (TM) MICROFILTRATION SYSTEM FOR THE TREATMENT OF DOMESTIC WASTEWATER EFFLUENTS.**  
Hydronautics, Inc., Laurel, MD.  
T. R. Sundaram, J. E. Santo, and J. A. Brown.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A040 482. Price codes: A04 in paper copy, A01 in microfiche. Technical Report 7658-1, January 1977. 72 p, 15 fig, 7 tab, 11 ref, 2 append.

Descriptors: \*Filtration, \*Pores, \*Porous media, \*Domestic wastes, \*Oil-water interfaces, Sludge treatment, Dewatering, Incineration, Suspended solids, Sludge disposal, Separation techniques, Waste water treatment, Municipal wastes.

Cross flow microporous filtration further increases the solids content of already concentrated human wastes. The microfiltration system consists of Hydroperm microporous tubes, developed by Hydronautics, Inc. of Laurel, Maryland, which are constructed of polyethylene, nylon, polyvinyl chloride, or noryl with pores ranging in size from 2-10 microns. Sludge dewatering is enhanced by the addition of an oil to fluidize the waste. The Hydroperm tubes are capable of separating water and oil emulsions, thus achieving up to 98% dewatering. The permeate produced is free of suspended solids and may be polished before discharge. The concentrate may be further dewatered on incinerated directly because of the high hydrocarbon content. The Hydroperm system is cost-effective on a small scale, with a capital outlay of \$2,800-5,000 for a 100 liter/day plant. The microfiltration process was developed for use on naval ships and field troop installations. (Lisk-FIRL)  
W78-07526

**PROCESS DESIGN MANUAL FOR PHOSPHORUS REMOVAL.**  
Shimek, Roming, Jacobs and Finklea, Dallas, TX.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 150. Price codes: A13 in paper copy, A01 in microfiche. Report EPA-625/1-76-001a, April 1976. 290 p, 53 fig, 57 tab, 178 ref, 2 append.

Descriptors: \*Chemical precipitation, \*Phosphorus, \*Nutrient removal, \*Iron, \*Lime, Phosphorus compounds, Chemical reactions, Settling basins, Trickling filters, Eutrophication, Waste water treatment, Activated sludge.

Chemical precipitation techniques were reviewed for the removal of phosphorus and its precipitate from waste water to prevent eutrophication of

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

over-fertilization in receiving waters. The kinetics of phosphorus precipitation by chemical additions were described for the various forms of phosphorus found in waste water. Chemical precipitation of phosphorus before primary settlement was tested with alum, iron, and lime as precipitants. The addition of mineral coagulants to trickling filters, activated sludge plants, and secondary effluents was also studied. Lime was used to precipitate phosphorus removal by chemical precipitation in pilot and full-scale plants were performance, equipment, designs, and costs. Recommendations on the storage techniques and dosing rates and amounts were presented. Methods were evaluated for sludge handling and dewatering. (Lisk-FIRL) W78-07527

#### POLISH/U.S. SYMPOSIUM ON WASTEWATER TREATMENT AND SLUDGE DISPOSAL: VOLUME II

Environmental Protection Agency, Cincinnati, OH. Office of Research and Development. Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 422. Price codes: A08 in paper copy, A01 in microfiche. Report EPA-600/9-76-021, September 1976. 167 p, 53 fig, 49 tab, 60 ref.

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Biodegradation, \*Textiles, \*Tannery wastes, \*Steel, Organic wastes, Toxicity, Waste water treatment, Industrial wastes, Municipal wastes, \*Poland, United States.

The proceedings of the Polish/U.S. symposium on waste water treatment and sludge disposal, held in Cincinnati, Ohio, on February 10-12, 1976, contain 15 discussions on municipal and industrial waste water treatment practices and water conservation alternatives. Specific topics include: sludge treatment and disposal; treatment of steel processing, coke plant, tannery, and textile wastes; biodegradability assessments; and toxicity analyses of organic compounds. The symposium focuses on studies that were undertaken for seven water projects conducted in Poland on: the treatment of industrial wastes; biological, physical, and chemical waste water treatment techniques; sludge use; and waste water reuse. The Polish delegation represented the Ministry of Administration, the Institute for Economy and Water Management, the Institute of Environmental Protection Engineering, the Environmental Pollution Abatement Center, and the Institute of Municipal Economy. The United States delegation was composed of Environmental Protection Agency representatives and members of Carnegie-Mellon University, Clemson University, and the University of Cincinnati. (See W78-07531 and W78-07532) (Lisk-FIRL) W78-07530

#### THE RESEARCH WORKS ON SEWAGE TREATMENT IN POLAND, Department of Waste Water Technology and Sludge Disposal, Warsaw (Poland). Local Economy and Environment Protection. S. Nawara.

In: Polish/U.S. Symposium on Wastewater Treatment and Sludge Disposal: Volume II, February 10-12, 1976. Report EPA-600/9-76-021, 1976, p 2-10.

Descriptors: \*Poland, \*Research and development, \*Research priorities, \*Project planning, \*Sewage treatment, \*Optimum development plants, Sewerage, Treatment facilities, Industrial wastes, Legal aspects, Waste water treatment, Municipal wastes.

Sewage treatment research, management, and legislation in Poland are discussed. Surface water pollution in Poland results from industrial and municipal operations lacking adequate treatment facilities for chemical, food, and wood processing

wastes. Industrial plants are responsible for about 80% of all wastes generated; about 60% of the total waste water volume receives some form of treatment. Technologies have been developed for biological and physicochemical treatment of phenol-bearing waste water; biological treatment of cellulose sulfate wastes; salinated mine water treatment by thermic and hydrothermic methods; storage and treatment of dairy wastes in biological lagoons; and the elimination of hydrogen sulfide from sulfur mine wastes. Future water quality improvement research areas include pilot plant programs, water use optimization, production of biodegradable domestic and industrial materials, data collection systems, and further development of sewage and industrial waste treatment plants. Operations at the biological waste water treatment plant in Czeszochowa, Poland, treating a combined municipal and industrial waste water flow, are reviewed. (See also W78-07530) (Lisk-FIRL) W78-07531

#### CONCEPTS, CRITERIA, AND MEASUREMENTS OF BIODEGRADABILITY, Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div. R. L. Bunch.

In: Polish/U.S. Symposium on Wastewater Treatment and Sludge Disposal: Volume II, February 10-12, 1976, p 132-140. Report EPA-600/9-76-021.

Descriptors: \*Biodegradation, \*Biological treatment, \*Analytical techniques, \*Activated sludge, \*Biochemical oxygen demand, Microbial degradation, Oxygen demand, Equipment, Sewage treatment, Measurement, Laboratory tests, Waste water treatment.

Biodegradation criteria and analyses of waste water compounds that pose a potential threat to the environment are reviewed. Polluting compounds in the waste water must first be identified; the extent of degradation required to obviate their effects should be determined. Future criteria for the degradation of polluting compounds to cell matter, carbon dioxide, and water are recommended to reduce the input of harmful substances to potable and surface waters. Methods of calculating the biodegradability of waste water-borne compounds are reviewed. These include: river die-away or natural microbial degradation in rivers; Warburg respirometry to measure oxygen demand of microorganisms; BOD tests for dissolved oxygen uptake; flask tests with a chemically defined medium and preadapted seed; and the activated sludge method in continuous or semicontinuous flows. Laws mandating the use of biodegradable materials and further research in biodegradation byproducts, rates, and extents are recommended. (Lisk-FIRL) W78-07532

#### CROSS-FLOW FILTRATION IN PHYSICAL-CHEMICAL TREATMENT OF MUNICIPAL SEWAGE EFFLUENTS, Oak Ridge National Lab., TN.

H. A. Mahlman, W. G. Sisson, K. A. Kraus, and J. S. Johnson, Jr. Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 443. Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-76-025, February, 1976. 126 p, 54 fig, 11 tab, 38 ref. Also issued as ORNL/TM-5423. W-7405-eng-26.

Descriptors: \*Filtration, \*Activated carbon, \*Chemical treatment, \*Aluminum, \*Iron, Activated carbon, Chemical precipitation, Filters, Phosphates, Nutrient removal, Tertiary treatment, Waste water treatment, Municipal wastes, Turbidity.

Cross-flow filtration was evaluated for the physical-chemical treatment of primary effluent and activated sludge effluent by conditioning with iron or

aluminum salts, or powdered activated carbon as reagents. The cross-flow filtration process involves passing of the effluent flow parallel to a filter surface composed of fire hose jacket fabric to delay the accumulation of flux-limiting filter cake and to separate the influent into filtrate and a concentrated solids slurry. Addition of iron or aluminum salt to primary effluent resulted in a filtrate with 10-15 mg/liter total organic carbon (TOC), <1 mg/liter total phosphate, and a turbidity of <1 Jackson Turbidity Unit. Cross flow velocities of 4.6 m/sec produced average fluxes of 6 m/day with metallic salt treatment; neutralization was necessary before metallic salt addition to prevent contamination of the filtrate. Powdered activated carbon treatment of the primary effluent yielded a filtrate quality similar to that produced by metallic salt treatment but with a lower TOC of 5 mg/liter. Treatment of activated sludge effluent with aluminum salt, iron salt, powdered activated carbon, added separately or in combination, resulted in a higher turbidity, phosphate content, and bacterial population than for primary effluent. Ferric chemical and cross-filtration treatment of primary effluent flows to a plant at 3,800 cu m/day was estimated to cost \$1.12/cu m. Further research is suggested on various treatment chemicals, the effects of low circulation velocities, and cross-flow filtration of industrial wastes. (Lisk-FIRL) W78-07533

#### COTTAGE FARM COMBINED SEWER DETENTION AND CHLORINATION STATION, CAMBRIDGE, MASSACHUSETTS, Massachusetts Metropolitan District Commission, Boston.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 292. Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-046, February 1977. 115 p, 24 fig, 22 tab, 5 ref, 5 append. 11020FAT.

Descriptors: \*Overflow, \*Water storage, \*Combined sewers, \*Chlorination, \*Discharge(Water), Treatment facilities, Screens, Settling basins, Conveyance structures, Hydraulic structures, Wells, Disinfection, Waste water treatment, Municipal wastes.

The performance of the Cottage Farm Detention and Chlorination Station, Cambridge, Massachusetts, was evaluated during its initial 3 yrs of operation during periods of combined sewer overflows from the Charles River Valley sewer systems. The station, with a peak flow capacity of 233.1 mgd, diverts and treats combined sewer flows that exceed the capacity of the Deer Island Treatment Plant. Six detention tanks with a capacity of 1.2 million gal and a wet well holding up to 0.1 million gal contain the overflows; waste water flows up to the 5 yr design storm capacity are screened, skimmed, settled, chlorinated, and discharged to the Deer Island treatment facility when downstream flows subside. The Cottage Farm Station removed 45% of the suspended solids, 99.9% of the coliform bacteria, 69% of the settleable solids, and 42% of the BOD load. During the first three years of operation, the station completely contained 32 of the 114 overflows; overflows not completely detained by the Cottage Farm station were treated with a sodium hypochloride solution before discharge to the Charles River Basin. Based on an estimated 33 overflows each year, the Cottage Farm station would be available 300 days of the year for the other purposes, such as treatment of the Charles River water. (Lisk-FIRL) W78-07534

#### SEWAGE SYSTEM REJUVENATION.

For primary bibliographic entry see Field 8G. W78-07535

#### CIRIA STREAMLINES TANK DESIGN.

New Civil Engineer, p 7, January 5, 1978.

Descriptors: \*Specification, \*Biological treatment, Construction, Municipal wastes

The standard in England has been the use of circular tanks with diameters ranging from 10 to 15 m. In surface loading, the required area for a given flow rate is a function of the depth of the tank. More gradual slopes are not required. treatment and formulated. (Lisk-FIRL) W78-07549

#### EFFECT OF MOLECULAR WEIGHT ON THE PERFORMANCE OF ACETYL CELLULOSE MEMBRANES

Seaford Technical College, Sussex, England; and Georgia Institute of Technology, Atlanta, Georgia. University Center, Technical Report, 29 p, 7 fig, 4 tab.

Descriptors: \*Performance, \*Viscosity, \*Filtration, \*Chitosan, \*Weight distribution

Analysis of the time of day, moisture content to 10.0, res decreased sh to 67%, then Viscosity also hour, then decreased to acid solution chitosan porous treated sludge wastes was h 2 hours. Th those deacti two hours. viscosity or r tempted for hours. Molec better correl treatment agn W78-07552

#### REUSE OF GROUNDWATER

S.C.S. Engineers, C.J. Schmidt Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 292. Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-046, February 1977. 115 p, 24 fig, 22 tab.

Descriptors: \*Treatment, \*Artificial, \*Municipal wastes, \*Groundwater, \*Quality control, \*Effluents, \*Construction



Descriptors: \*Settling basins, \*Design standards, \*Specifications, \*Sedimentation, \*Design data, Biological treatment, Sludge treatment, Equipment, Construction, Waste water treatment, Municipal wastes.

The standardization of sedimentation tank designs in England has been proposed by the Construction Industry Research and Information Association. A report on preferred sedimentation tank designs lists specifications for diameters, depths, and floor slopes for circular and rectangular tanks. For circular tanks serving populations of 3,000-250,000 diameters ranging in size from 8-30 m are preferred. In large diameter tanks with a 2 m/hr surface loading rate, a 2.5 m diameter increase is required for a 7,000 population increase. Preferred sidewall depths for tanks are 2, 2.4, and 3 m, with depths of 4 m in the higher diameter ranges. Four floor slopes are offered: 1/2, 1/5, 1/10, and 1/500. More gradual slopes are allowed when shutters are not required. Reports on standardizing biological treatment and sludge treatment plants are being formulated. (Lisk-FIRL)

W78-07549

**EFFECT OF TIME OF DEACETYLATION ON MOLECULAR WEIGHT DISTRIBUTION, ACETYL CONTENT, VISCOSITY, AND PERFORMANCE OF CHITOSAN AS A CONDITIONING AGENT FOR ACTIVATED SLUDGE,** Seaford Technology Laboratory, Brunswick, GA; and Georgia Univ., Experiment, GA. Dept. of Food Science. W. A. Bough, A. C. M. Wu, and W. B. Miller. Georgia University System, Marine Science Center, Technical Report Series No. 77-7, (1977). 29 p, 7 fig, 4 tab, 19 ref.

Descriptors: \*Activated sludge process, \*Coagulation, \*Waste water treatment, Performance, Viscosity, Acetyl content, Deacetylation, \*Chitosan, \*Conditioning agents, Molecular weight distribution.

Analysis of chitosan products differing only in time of deacetylation showed that ash and moisture contents ranged from 0.05 to 0.2 and 5.6 to 10.0, respectively. Degree of deacetylation decreased sharply in the first 30 minutes from 14% to 67%, then slowly decreased to 79% in 5 hours. Viscosity also decreased sharply in the first one hour, then in the next 2 to 5 hours slowly decreased to about 200 cps at 10 g/l in 2% acetic acid solution. The effectiveness of the different chitosan products as coagulants in dewatering activated sludge grown on vegetable processing wastes was highest for the sample deacetylated for 2 hours. This product was more effective than those deacetylated for shorter or longer times than two hours. Correlation of effectiveness vs. viscosity or molecular weights of products was attempted for products deacetylated for 0.5, 1, and 2 hours. Molecular weight distribution data showed better correlation with effectiveness as a waste treatment agent than did viscosity data. (NOAA) W78-07552

**REUSE OF MUNICIPAL WASTEWATER FOR GROUNDWATER RECHARGE,** SCS Engineers, Inc., Long Beach, CA. C. J. Schmidt, and E. V. Clements. Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 620. Price codes: A08 in paper copy, A01 in microfiche. Report EPA-600/2-77-183, September, 1977. 151 p, 19 fig, 29 tab, 30 ref, 6 append.

Descriptors: \*Water reuse, \*Waste water treatment, \*Artificial recharge, Water conservation, Municipal wastes, Injection wells, Sites, Percolation, Groundwater movement, Pollutants, Water quality control, Tertiary treatment, Monitoring, Effluents, California, New York.

The report concerns only formal ground water recharge operations with municipal waste water effluents. As of 1977, this type of activity was underway at 10 sites with an estimated total capacity of 77 MGD, however, the inadvertent uncontrolled recharge of treated effluent discharged to land (e.g., by small rural facilities) and continuous release of septic tank wastes amounts to far greater volumes than for the formal programs discussed. Seven of the sites studied employ percolation-type programs, the most successful practice being alternate flooding and drying. The other three sites practice well injection, which can be successful only if rigorous control of injected water quality is maintained. Sufficient data to define the movement of salts, trace organics, or pathogens as a function of soil and ground water characteristics and hydraulics have not yet been developed to permit quantitative water quality requirements to insure successful recharge over long periods. Intensive monitoring of present and other new sites is therefore recommended as a means of gathering data upon which rational design criteria can be based. (Eberle-NWVA) W78-07570

#### WASTEWATER TREATMENT SYSTEM.

Chemical Engineering, Vol. 85, No. 2, p 95, January, 1978.

Descriptors: \*Aeration, \*Equipment, \*Oxygenation, \*Sewage treatment, \*Design data, Municipal wastes, Costs, Waste water treatment.

The Clevepak Corp of Fall River, Massachusetts, has begun marketing a submerged aeration system for the secondary treatment of waste water. The Aerocleve system provides air bubbles in a size range of 0.2-0.4 mm, increasing efficiency over conventional diffused air devices and mechanical aerators which produce bubbles in the range of 1.0-2.5 mm. Waves which trap pockets of air and strike the walls of the chamber are created by differences in air and waste water velocities in the Aerocleve's mixing chambers. Fine air bubbles are released when the air pockets impinge against the wall of the chamber. An oxygen transfer efficiency of 4.0-6.0 lb O<sub>2</sub>/brake hp-hr is reported for the Aerocleve system. (Lisk-FIRL) W78-07580

#### PRESERVATION OF PHENOLIC COMPOUNDS IN WASTEWATERS,

National Enforcement Investigations Center, Denver, CO. M. J. Carter, and M. T. Huston.

Environmental Science and Technology, Vol 12, No 3, p 309-312, March, 1978. 5 fig, 1 tab, 39 ref.

Descriptors: \*Chemical wastes, \*Phenols, \*Copper sulfate, \*Phosphorus compounds, \*Sodium compounds, Sulfur compounds, Storage, Microbial degradation, Waste water treatment, Industrial wastes.

The stabilization of phenolic compounds in waste water by treatment with a strong acid or base was compared to preservation by the addition of copper sulfate in combination with phosphoric acid. Phenolic compound stability was assessed according to microbial activity after retention times of 1 hr, 8 days, and 20 days at 4 and 25°C. Sulfuric acid and sodium hydroxide were used as the preservative reagents. At a temperature of 4°C, phenolic compounds in waste water were effectively stabilized for at least 12 days with copper sulfate-phosphoric acid treatment. Sulfuric acid preserved the phenolic compounds in waste water for up to 28 days at 4°C; sodium hydroxide was an effective preservative for 26 days. Treatment of phenolic acid-bearing waste water with sulfuric acid at 4°C yielded the most consistent preservation. Copper sulfate-phosphoric acid treatment was not as effective as acid or base stabilization. The choice of sulfuric acid or sodium hydroxide as a phenolic acid preservative was considered to be

dependent upon the type of analysis of the waste employed after treatment. (Lisk-FIRL) W78-07586

#### POLLUTION CONTROL IN THE SYNTHETIC RESINS INDUSTRY,

CIBA-GEIGY Ltd., Duxford (England). Environmental Technical Services.

K. G. Singleton. Public Health Engineer, Vol. 6, No. 2, p 86-89, 1978. 1 fig, 5 tab, 8 ref.

Descriptors: \*Resins, \*Chemical wastes, \*Plastics, \*Treatment facilities, \*Activated sludge, Odor, Air pollution, Solid wastes, Domestic wastes, Biological treatment, Phenols, Waste water treatment, Epoxy resins, Industrial wastes.

Waste water, air pollution, and solid waste treatment practices of the Plastics Division of CIBA-Geigy Ltd of Duxford, Cambridge, England are discussed for resin-bearing chemical wastes. Synthetic resins manufactured include: urea-, melamine-, and phenol-formaldehyde resins, epoxy resins, and textile products. Because the waste water from synthetic resin production contains antiseptic, bactericidal formaldehyde and methanol, the waste is mixed with domestic sewage to generate biological activity. The waste water mixture is treated by the primary and secondary activated sludge method and biological filtration. Surplus activated sludge is stored for agricultural land application. BOD is reduced from 1,000-2,000 mg/liter to 2-4 mg/liter, formaldehyde from 100-600 mg/liter to 0.6 mg/liter, phenol from 10-100 mg/liter to 0.03 mg/liter, and permanganate value from 250-800 mg/liter to 12-14 mg/liter. Atmospheric emissions, containing urea-formaldehyde and melamine-formaldehyde resin powders, are reduced by 99.8% in a multicyclone unit followed by bag filtration. A counteractant system uses six lances for odor control. Solid wastes are either disposed of in a landfill, incinerated, or chemically treated. The economics of waste treatment operations in the resin production plant are reviewed. (Lisk-FIRL) W78-07587

#### PHOTOGRAPHIC PROCESSING EFFLUENT CONTROL,

Eastman Chemical Products, Inc., Kingsport TN. Photographic Technology Div.

T. J. Dagon. Journal of Applied Photographic Engineering, Vol 4, No 2, p 62-71, Spring, 1978. 10 tab, 33 ref.

Descriptors: \*Chemical wastes, \*Ozone, \*Activated carbon, \*Industrial wastes, Effluents, Reverse osmosis, Adsorption, Separation techniques, Water reuse, Recycling, Silver, Bleaching wastes, Biological treatment, Activated sludge, Oxidation, Chemical oxygen demand, Chemical precipitation, Tertiary treatment, Waste water treatment.

A state-of-the-art review of waste water treatment technology available to the photographic processing industry for control of oxygen demand, silver, and ferrocyanide in effluents is presented. Current treatment methods are based on biological treatment, activated carbon adsorption, ozonation, ferrocyanide precipitation, reverse osmosis, and ion exchange. Studies by the Eastman Kodak Co suggest that photoprocessing effluents may be biologically treated by extended-aeration activated-sludge processes, sand filtration, lagooning, and the rotating biological contractor. Experiments on the use of ozonation to degrade chemicals in various photoprocessing solutions indicate that only acetate and glycine are unaffected; the COD contributed by ethylene glycol, methanol, ferricyanide, and ethylene diamine is reduced. Ozone is also effective as a disinfectant and in reducing color and odor. More than 95% of the BOD-contributing components can be removed by either

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

ozonation or biological treatment. Because of its corrosive and unstable nature, threshold limit values and safety precautions are recommended for the use of ozone in the photoprocessing industry. Physical-chemical treatment is suggested for adsorbing dissolved organics from developer solutions. Methods of silver recovery, fixer reuse, bleach regeneration, bleach-fixers reuse, and color developer regeneration are outlined. (Schulz-FIRL)  
W78-07588

**OZONATION OF COAL GASIFICATION PLANT WASTEWATER.**  
Pittsburgh Univ., PA. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5A.  
W78-07589

**INDUSTRIAL WASTE MANAGEMENT IN THE DAIRY INDUSTRY IN POLAND.**  
Institute of Meteorology and Water Management, Warsaw (Poland).  
M. J. Gromiec.  
Industrial Wastes, Vol. 24, No. 2, p 22-26, March-April, 1978. 10 fig, 4 tab, 5 ref.

Descriptors: \*Poland, \*Dairy industry, \*Oxidation lagoons, \*Biochemical oxygen demand, \*Activated sludge, \*Food processing industry, \*Water quality standards, \*Storage tanks, \*Chemical oxygen demand, \*Suspended solids, \*Waste water treatment, \*Industrial wastes.

Improvements in the treatment of dairy waste waters in Poland by in-plant water conservation, recycling, and oxidation lagoons modifications were reviewed. BOD loads in powdered milk production effluents ranged 880-1,770 mg/liter with permanganate values of 280-980 mg/liter. Improvements within the dairy plant, including rinse water recycling, milk reuse, elimination of leaks, and reuse of cooling water and condensates, resulted in a BOD reduction to 840-960 mg/liter and a permanganate value decrease to 320-360 mg/liter. Collection in holding tanks for discharge to sewers of whey waste water from the production of cheese and casein reduced BOD from 2020 mg/liter to a low of 1,650 mg/liter. Oxidation ditches, singular, in series, or in conjunction with aeration and activated sludge treatment, with population capacities of 600-20,000 reduced BOD by 40-99%. Promlecz tanks with two-stage activated sludge treatment were employed for large dairy plants which process 300,000-1,000,000 liters of milk daily. BOD removals by the Promlecz type activated sludge tank with aeration brushes and surface aerators ranged 98.5-99.6%. Modifications of existing plants to upgrade dairy waste water treatment were presented. (Lisk-FIRL)  
W78-07590

**STARCH-LADEN EFFLUENT TREATMENT-A CASE HISTORY.**  
Vickerys Ltd., London (England).  
G. J. Banks.  
Filtration and Separation, Vol. 15, No. 2, p 137-139, March-April, 1978. 3 fig, 1 tab.

Descriptors: \*Food processing industry, \*Potatoes, \*Sieves, \*Centrifugation, \*Separation techniques, \*Chemical oxygen demand, \*Biochemical oxygen demand, \*Suspended solids, \*Sewerage, \*Waste water treatment, \*Industrial wastes.

A case history is presented for the treatment of starch-bearing waste water from the potato processing industry. Potato processing effluent can be partially treated by coarse screening of large debris and storm water, followed by removal of fats, greases, oils, and potato waste solids. Further solids removal is achieved by primary, secondary, and tertiary cyclone centrifugation followed by solids settlement. Potato solids are chopped and passed over a Hydrosieve, manufactured by Vickerys, Ltd of London, England, con-

taining a series of inclined screen plates which collect the solids. The filtrate from the Hydrosieve is pumped through centrifugal cleaners before discharge into municipal sewers. The screens in the Hydrosieve are inclined at 25, 35, and 45 degrees with apertures ranging 0.010-0.100 inches and capacities of 0-40,000 gal/hr. The 110 gal/min centrifugal cleaners operate at a pressure of 50 psi. This method of treating potato processing wastes reduces COD by 82%, suspended solids by 92%, and BOD by 90%. (Lisk-FIRL)  
W78-07591

**THE RECOVERY OF PROTEIN FROM POTATO JUICE WASTE WATER BY FOAM SEPARATION.**  
Groningen Rijksuniversiteit (Netherlands). Lab. for Chemical Engineering.  
D. C. Weijenberg, J. J. Mulder, A. A. H. Drinkenburg, and S. Stemerding.  
Industrial and Engineering Chemistry Process Design and Development, Vol 17, No 2, p 209-213, April, 1978. 8 fig, 10 ref.

Descriptors: \*Foam separation, \*Separation techniques, \*Proteins, \*Potatoes, \*Food processing industry, \*Industrial wastes, \*Nutrient removal, \*Foam fractionation, \*Waste water treatment.

The efficiency of protein recovery from potato processing waste water by foam separation is dependent upon physical processes which concentrate the protein at the liquid-gas interface. Laboratory experiments were performed to examine the excess surface concentration of organics at the liquid-gas interface with respect to the bulk concentration, temperature, pH, and NaCl addition. Foam density and stability and the rate at which protein collected at the interface were also considered in an effort to define optimum operating parameters for a technical separation process. The maximum excess surface concentration was achieved at a pH of 7 and a bulk protein concentration of 1:10 diluted potato juice. The time required to reach this equilibrium concentration was estimated at 18-20 sec. Salt additions and temperature increases did not significantly enhance protein concentration. (Schulz-FIRL)  
W78-07592

**PLATER MEETS 'NEW SOURCE' REQUIREMENTS.**  
E. A. Blount.  
Products Finishing, Vol. 42, No. 6, p 38-45, March, 1978.

Descriptors: \*Metals, \*Copper, \*Chromium, \*Nickel, \*Evaporators, \*Recycling, \*Chemical precipitation, \*Nitrogen compounds, \*Filters, \*Chemical wastes, \*Waste water treatment, \*Industrial wastes.

Treatment processes in a metal plating plant can be used to clarify rinse waters and recover chemical and metals for reuse in the plating processes. The Top Notch Metal Finishing Co in East Rutherford, New Jersey, performs copper-nickel-chromium and nickel-chromium plating of automotive steel parts and appliances. Rinse waters from the plating processes are vacuum-evaporated in single or double effect Wastesavers with steam at a pressure of 96.5 kilo-pascals. Chemical decomposition during evaporation is prevented by the lower temperature of the steam allowed by the vacuum. Nickel rinse water is evaporated in two 75 gal/hr double effect Wastesavers; chromium plating rinse is channeled to two 50 gal/hr evaporators; bright acid copper rinse water is evaporated in one 175 gal/hr double effect Wastesaver; and nickel strike rinse is routed to one 75 gal/hr single effect evaporator. The evaporated water is distilled and returned to the appropriate counterflow rinsing tank. Concentrated chemicals are reused in the plating tanks. Cyanide-bearing rinse water is

treated with alkaline chlorination and pumped to a neutralization tank. Chromium in waste water is reduced to its trivalent form; the water is neutralized before precipitation of metal hydroxides. Rinse water containing copper or nickel is routed to the neutralization and precipitation tanks. Precipitates are filtered with a plate and frame press; filtrates are discharged to the sewers while solids are disposed of in a landfill. (Lisk-FIRL)  
W78-07593

**BINDING OF HEAVY METAL IONS BY FORMALDEHYDE-POLYMERIZED PEANUT SKINS.**  
Western Regional Research Lab., Berkeley, CA.  
J. M. Randall, E. Hautala, and G. McDonald.

Laboratory columns packed with peanut skins polymerized with formaldehyde were used in tests on ion exchange removal of heavy metals from industrial waste water. To prevent leaching of the color soluble, low molecular weight tannins into the water and the disintegration of the peanut skins, the skins were pretreated with hot acidic, aqueous formaldehyde. The polymerized peanut skins were packed at a density of 0.15 g/cc into glass columns 25, 50, and 100 cm long. The ion exchange column was effective in removing copper, cadmium, silver, mercury, lead, and zinc. Substrate removal capacities for these ions were 1.32 milliequivalents (meq)/g substrate for divalent cadmium, 3.0 meq/g for divalent copper, and 1.97 meq/g for lead. Tests with a solution bearing a number of heavy metal ions indicated that mercury, lead, and copper were rapidly removed on the peanut skins while cadmium, nickel, and zinc were bound only after the preferred heavy metal ions were removed on the packing. (Lisk-FIRL)  
W78-07594

**KINETIC STUDIES ON THE LIME SULFURATED SOLUTION (CALCIUM POLYSULFIDE) PROCESS FOR REMOVAL OF HEAVY METALS FROM WASTE WATER.**  
Shinshu Univ., Matsumoto (Japan). Dept. of Chemical Engineering.  
K. Yahikozawa, T. Aratani, R. Ito, T. Sudo, and T. Yano.  
Bulletin of the Chemical Society of Japan, Vol. 51, No. 2, p 613-617, February, 1978. 8 fig, 7 ref.

Descriptors: \*Chemical precipitation, \*Heavy metals, \*Carbon dioxide, \*Aeration, \*Coagulation, \*Mercury, \*Calcium compounds, \*Lime, \*Cadmium, \*Zinc, \*Lead, \*Copper, \*Chromium, \*Sulfur compounds, \*Laboratory tests, \*Waste water treatment, \*Industrial wastes.

The kinetics of heavy metal precipitation from industrial waste water were studied in laboratory tests with a lime sulfurated solution containing calcium polysulfide and aeration with carbon dioxide or air. The lime sulfurated solution requires only one coagulation step to precipitate heavy metals; the sodium sulfide coagulant requires a second precipitant for complete metal precipitation. Calcium polysulfide, whose chemical formula has a sulfur subscript of 4.7-5.4, is a slowly decomposing agricultural insecticide or disinfectant whose decomposition is rapidly increased by aeration with carbon dioxide. In a batch-stirred laboratory tank, bivalent mercury, cadmium, zinc, lead, and copper, trivalent cadmium, and hexavalent cadmium were precipitated by calcium polysulfide additions. Carbon dioxide aeration effected a more rapid decomposition of calcium polysulfide than air, forming calcium thiosulfate, hydrogen sulfide, and solid sulfur. The bivalent metals were precipitated as metal sulfides, at a rate dependent upon the decomposition rate of calcium sulfide. Hexavalent chromium was reduced to trivalent form and precipitated as chromium hydroxide. Trivalent chromium was more rapidly precipitated as a metal hydroxide with air infusion rather than carbon dioxide aeration. The precipitation process was completed within 60 min with calcium polysulfide coagulation. (Lisk-FIRL)

W78-07595

**ARRESTMENT OF ROUS METAL**  
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**A TEST AN**  
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Federal Paper  
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**CONCENTR**  
SULFITE P  
REVERSE O  
National Ch  
(Japan).  
H. Masuda, C  
and T. Sakai.  
Desalination  
6 fig, 2 tab, 5

Descriptors: \*O  
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W78-07595

**ARRESTMENT OF FUMES IN THE NON-FERROUS METALS INDUSTRY.**

International Environmental Bureaux for the Non-Ferrous Metals Industries, Wantage (England).  
For primary bibliographic entry see Field 5G.  
W78-07596

**A TEST AND A TECHNIQUE FOR PREDICTING BOD5 VALUES OF KRAFT MILL WASTE.**  
Federal Paper Board Co., Riegelwood, NC.  
For primary bibliographic entry see Field 5A.  
W78-07597

**CONCENTRATION OF ACETIC ACID IN SULFITE PULP EVAPORATION DRAIN BY REVERSE OSMOSIS.**

National Chemical Lab. for Industry, Tokyo (Japan).  
H. Masuda, C. Kamizawa, K. Hata, K. Yokota, and T. Sakai.  
Desalination, Vol. 25, No. 1, p 89-97, March, 1978. 6 fig, 2 tab, 5 ref.

Descriptors: \*Pulp and paper industry, \*Sulfite liquors, \*Organic acids, \*Reverse osmosis, \*Neutralization, Evaporation, Salts, Sodium compounds, Ammonium compounds, Calcium hydroxide, Membrane processes, Waste water treatment, Industrial wastes.

A process using reverse osmosis was developed for the recovery of fatty acids, primarily acetic acid as an azeotropic mixture, in a 4% concentrated solution from the evaporation drainage waste of spent sulfite liquor. The acetic acid, contained in the distillate from spent sulfite liquor concentration, was recovered as a culture medium for yeast. To prevent the acetic acid from passing through the cellulose acetate membrane and the membrane from corroding, the distillate was neutralized by NaOH, NH<sub>4</sub>OH, or Ca(OH)<sub>2</sub> additions to form acetate salts. A membrane pressure of 60 atmospheres was recommended to concentrate the acetic acid from the initial 1.35% to the desired 4%. Acetic acid recovery from the spent sulfite liquor distillate after neutralization and reverse osmosis was 95.6% with NaOH, 90.5% with NH<sub>4</sub>OH, and 98.2% with Ca(OH)<sub>2</sub>. Although the Ca(OH)<sub>2</sub> yielded the highest recovery rate, a hard scale composed of CaSO<sub>3</sub> or CaSO<sub>4</sub> was deposited on the membrane. Scaling did not hinder membrane performance. (Lisk-FIRL)  
W78-07598

**ADSORPTION OF TEXTILE DYES BY ACTIVATED CARBON PRODUCED FROM AGRICULTURAL, MUNICIPAL AND INDUSTRIAL WASTES.**

Georgia Inst. of Tech., Atlanta. School of Chemical Engineering.  
M. Mitchell, W. R. Ernst, E. T. Rosmussen, P. Bagherzadeh, and G. R. Lightsey.  
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 3, p 307-311, 1978. 4 tab, 9 ref.

Descriptors: \*Activated carbon, \*Textiles, \*Dyes, \*Incineration, \*Organic wastes, Farm wastes, Municipal wastes, Sewage sludge, Peanuts, Sawdust, Bark, Fibers(Plant), Waste water treatment, Filtration, Industrial wastes.

Dye removal from textile industry effluent was investigated with activated carbon pyrolyzed from a variety of solid waste materials. Solid waste materials used to provide activated carbon included: peanut hulls, bagasse, hardwood sawdust, pine bark, pine sawdust, and sewage sludge. The solid wastes were pyrolyzed at 650-850°C and activated by steam infusion at 800°C. Brunauer-Emmett-Teller (BET) surface area values for the activated carbon particles ranged from 49 sq m/gm

for sewage sludge to 573 sq m/gm for peanut hulls. The aqueous dye solutions filtered through the activated carbon contained 1.579 gm of neutralized basic yellow 25, direct orange 34, or acid red 182. Activated carbon pyrolyzed from peanut hulls removed all basic yellow and direct orange dyes from the solution and decreased acid red concentrations to 3.5 ppm. Relative dye removal efficiencies for the various types of activated carbon tested were: hardwood sawdust>sewage sludge>pine sawdust>bagasse>pine bark. The optimum dye level for activated carbon pyrolyzed from peanut hulls was 30 mg dye/gm carbon, permitting less than 1 ppm residual basic yellow or direct orange to remain in solution. Activated carbon adsorption of acid red was approximately 60% as efficient. In addition to BET, pore size and surface charge were cited as other factors influencing adsorption. (Lisk-FIRL)  
W78-07599

**DYE WASTE TREATMENT AND REUSE.**  
Meyer, Meyer, LaCroix and Hixson, Alexandria, LA.  
L. E. Shriver, and R. R. Daugue.  
American Dyestuff Reporter, Vol. 67, No. 3, p 34, 36-38, 40, 42, 50, March, 1978. 7 fig, 7 tab, 7 ref.

Descriptors: \*Dyes, \*Textiles, \*Activated sludge, \*Pilot plants, \*Mathematical models, Design data, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Color, Nitrogen, Phosphorus, Analytical techniques, On-site investigations, Waste water treatment, Industrial wastes.

Pilot studies were conducted in Wansona Industries' Wadesboro plant in North Carolina on the reduction of BOD, COD, suspended solids, and color in dyebath waste water by the activated sludge treatment method. The raw process stream from the dyeing plant contained 200 mg/liter BOD, 545 mg/liter COD, 50 mg/liter suspended solids, 640 color units measured by the APHA Platinum-Cobalt Standard, and low phosphorus and nitrogen concentrations. Four continuous-flow activated sludge units, equipped with aeration chambers, air supplies, clarifiers, and sludge returns, were operated with detention times of 12, 24, 36, and 48 hrs. Significant reductions in BOD, COD, and color were achieved with the 48 hr retention time; suspended solids removal was limited. The study indicated that the raw process water had a low BOD exertion ratio, a high soluble solids content, and nutrient deficiencies. A graphic analysis of the substrate removal ratio for the raw process waste was applied to design criteria for a full-scale activated sludge treatment system. Using the data obtained from the pilot plant study, a design equation was formulated to estimate aeration basin, oxygen, and horsepower requirements, as well as sludge production and operational performance. (Lisk-FIRL)  
W78-07600

**CHROME DYEING OF WOOL: REDUCING THE AMOUNT OF CHROMIUM IN THE RESIDUAL BATH.**  
International Wool Secretariat, Ilkley (England).  
Technical Centre.  
L. Benisek.

Journal of the Society of Dyers and Colourists, Vol. 94, No. 3, p 101-105, March, 1978. 4 tab, 26 ref.

Descriptors: \*Chromium, \*Dyes, \*Organic acids, \*Textiles, \*Boiling, Chemical wastes, Dye concentrations, Oxidation, Chemical reactions, Waste water treatment, Industrial wastes.

The reduction of hexavalent and trivalent chromium concentrations in wool dyebaths was effected most efficiently by lactic acid under controlled pH. Organic acid solutions evaluated for chromium conversion included: 80% lactic acid, 66% glycolic acid, 90% formic acid, 100% acetic acid,

and 50% gluconic acid. Water quality standards assumed for chromium reduction were 0.2-0.5 mg/liter for hexavalent chromium and 2-4 mg/liter for trivalent chromium. Lactic acid was added to a previously boiled chromium dyebath with a dye to dichromate ratio of 4:1 at pH 3.4-3.6. The 3% lactic acid solution was boiled for periods of 15 and 30 min. The lowest total residual chromium concentration, 4.5 ppm, was achieved with a 30 min boiling period before and after lactic acid addition to a dyebath with a total chromium content of 33.6 ppm. The partial reduction of unreacted dichromate on the wool caused by the lactic acid after-thermochrom treatment improved some of the physical characteristics of the wool, such as the Martindale abrasion resistance, tensile strength, alkali solubility, and pilling. The lactic acid treatment of residual chromium was more cost effective than the other acid processes tested. (Lisk-FIRL)  
W78-07601

**TREATMENT OF SOME INDUSTRIAL EFFLUENTS IN MALAYSIA.**  
Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering; and Newcastle-upon-Tyne Univ. (England). Public Health Engineering Div.  
P. C. G. Isaac.  
Public Health Engineer, Vol. 6, No. 2, p 102-108, 1978. 5 fig, 4 tab.

Descriptors: \*Food processing industry, \*Tannery wastes, \*Rubber, \*Textiles, \*Metals, Biological treatment, Percolation, Oxidation lagoons, Chemical precipitation, Screens, Chromium, Anaerobic digestion, Aerobic conditions, Waste water treatment, Industrial wastes, \*Malaysia.

Malaysian waste treatment practices are reviewed for palm oil processing, rubber processing, electroplating, textile, and tanning industries. Waste water from palm oil processing containing 20,000 mg of BOD/liter is biologically treated in a series of five anaerobic primary and secondary ponds to reduce BOD to 600 mg/liter. Dewatered palm oil sludge can be used for animal feed as a concentrated protein source. Rubber processing wastes, with BOD levels as high as 12,000 mg/liter and high nitrogen concentrations, are used to fertilize fodder and rice crops. The rubber processing effluent is partially treated in stabilization ponds; full treatment methods incorporating trickling filters or anaerobic and aerobic ponds are being investigated. The volume of waste water produced during tannery processes is reduced by in-plant methods; the waste water is initially screened to remove hair and flesh. Settled waste bearing chromium and lime can be mixed with sulfide and passed through trickling filters to reduce BOD by 90%. Cotton manufacturing effluent, with a BOD load of 200-1800 mg/liter and an alkalinity of 300-900 mg/liter as CaCO<sub>3</sub>, is neutralized, screened, and pretreated before it is mixed with domestic wastes and biologically treated with trickling filters, activated sludge, or oxidation ponds. The toxic metals in electroplating waste waters are precipitated as metal hydroxides by pH adjustments. Hexavalent chromium must be reduced to trivalent chromium with sulfur dioxide or ferrous sulfate. Cyanide is successfully treated with alkaline chlorination. (Lisk-FIRL)  
W78-07602

**MUTANT BACTERIA SOLVE BOD PROBLEM AT HEAT PACKING PLANT.**  
Polybar Corp., NY.  
T. C. Zetrides.  
Industrial Wastes, Vol. 24, No. 2, p 40-41, March-April, 1978.

Descriptors: \*Food processing industry, \*Organic wastes, \*Biological treatment, \*Bacteria, \*Enzymes, Aeration, Aerated lagoons, Biochemical oxygen demand, Suspended solids, Waste water treatment, Industrial wastes.



### Group 5D—Waste Treatment Processes

**BIOLOGICAL WASTEWATER SYSTEM.**  
Chemical Engineering, Vol. 85, No. 2, p 96, January, 1978.

**Descriptors:** \*Biological treatment, Equipment, \*Microorganisms, \*Biochemical oxygen demand, \*Nitrification, Design data, Sewage treatment, Biodegradation, Ammonia, Waste water treatment.

Ecolot Inc of Bethpage, New York, manufactures the Hy-Flo fluidized bed system for biological waste water treatment. The system utilizes a compact reactor containing a high biomass concentration for carbonaceous BOD removal, nitrification, and denitrification. The high-rate system eliminates the need for large concrete tanks or basins. During operation, waste water entering the bottom of the reactor at a rate of 10-25 gpm/sq ft is contacted with more than 1,000 sq ft of biological growth/cu ft of reactor volume, 20-40 times that which would be expected from other commercially available systems. (Lisk-FIRL)  
W78-07656

**INDUSTRIAL SLUDGE AND ANIMAL SLURRY  
DE-WATERING.**  
Water and Waste Treatment, Vol. 20, No. 9, p 30,  
September, 1977.

**Descriptors:** \*Sludge treatment, \*Food processing industry, \*Industrial wastes, \*Slurries, \*Separation techniques, Dewatering, Screens, Sludge disposal, Waste water treatment, Treatment facilities, Design data, Equipment.

A patented device for dewatering sludge and separating liquid and solid wastes has been manufactured by Farrow Irrigation of England. The separator employs stationary screens, roll presses, and brushes. The two processing screens are constructed of stainless steel mesh and are supported by steel aperture plates. The rollers, covered in heavy rubber, and the polypropylene brushes are adjustable for increased compression of solids or wear uptake. The device has two speeds, a speed reduction mechanism, and is powered by a 1 hp electric motor. The separator has a treatment capacity of 5000 gph. Solids can be stored for composting after processing and liquids may be pumped to storage tanks with less probability of souring. (Lisk-FIRL)

W78-07657

**SEWAGE TREATMENT ROTARY DISTRIBUTOR RANGE EXTENDED.**  
*Surveyor*, Vol. 4447, No. 151, p 28, March, 1978.

**Descriptors:** \*Distribution systems, \*Plastics, \*Sewage treatment, \*Construction materials, \*Design data, Corrosion control, Pipes, Siphons, Irrigation systems, Waste water treatment, Municipal wastes.

Rotary distributors, developed by Treatment Plant Contracts Ltd of Andover, England, are being manufactured in a diameter range of 16-40 ft. The distributors are constructed of corrosion-resistant polyvinyl chloride and fiberglass-reinforced resin; they include a center underfed unit, a center overfed unit, and a taper unit. The overfed version requires support beams for diameters of 25 ft or more. A four inch column has replaced the three inch column in the 40 ft underfed siphon unit. The overfed, underfed, and taper units are manufactured in lengths of 5 or 7 ft and can accommodate the entire range of diameters. The 40 ft distributor has a capacity of 40 gal/day and is designed to treat wastes from a population of 500. (Lisk-FIRL) W78-07658

### MODULAR TREATMENT PLANT.

Water Services, Vol. 81, No. 982, p 758, December, 1977.

**Descriptors:** \*Treatment facilities, \*Concrete plants, \*Settling basins, \*Septic tanks, \*Filters, Storm water, Pumps, Aeration, Waste water treatment, Construction materials, Design data, Municipal wastes.

Modular waste water treatment plants are being manufactured by Albion of Swansea, England, to treat waste water flows from a single family dwelling to a population of 400. The modular components of the system are constructed of precast concrete. The component systems for a population of 4-141 include septic tanks, filters, pump wells, and soakaway and precast cesspools. A modular component system was installed in Talley, Dyfed, England, in a short period of time, despite adverse land conditions. The treatment system includes upflow settlement tanks, storm water tanks, a balancing tank, pump wells, a siphon chamber, humus tanks, and a wall unit filter. Albion is currently developing modular aeration plants to replace filters in restricted sites. (Lisk-FIRL) W78-07659

**SEWAGE DEWATERING PLANT FOR SMALL COMMUNITIES.**  
Water Services, Vol. 81, No. 982, p 747,  
December, 1977.

Descriptors: \*Sludge treatment, \*Dewatering, \*Treatment facilities, \*Aeration, \*Human population, Construction materials, Design data, Biochemical oxygen demand, Suspended solids, Waste water treatment, Municipal wastes.

Four sewage treatment and sludge dewatering plants are manufactured by Hawker Siddeley Water Engineering for population sizes ranging from 20,000. Five concrete extended aeration plants are available for populations of 250-1,000. The units, which lower the BOD and suspended solids content of the waste water, require sewage pretreatment with maceration or comminution and follow aeration with sedimentation and pebble bed clarification. The plant for treatment of waste water from a population of 75-500 is constructed of steel; extended aeration and sedimentation with pretreatment of the effluent are used. The concrete plant serving a population of 2,000-20,000 provides a variety of alternative treatment processes of modular design, such as aerobic digestion, clarification, polishing, and sludge dewatering. The compact steel unit for 2,000-20,000 employs degritting, preaeration, plug flow aeration, secondary sedimentation and aerobic

digestion in circular concentric tanks. The treatment plant lowers BOD and suspended solids levels to within quality standards. Potable water plants for populations of 300-7,000 are also available. (Lisk-FIRL)  
W78-07660

### A MULTI-STAGE FILTER BELT PRESS.

For primary bibliographic entry see Field 5E.  
W78-07666

## SOLIDS DEWATERING.

For primary bibliographic entry see Field 5E.  
W78-07675

**URBAN HYDROLOGICAL MODELING AND  
CATCHMENT RESEARCH: INTERNATIONAL  
SUMMARY.**

**SUMMARY,**  
American Society of Civil Engineers, New York.  
For primary bibliographic entry see Field 2A.  
W78-07689

**URBAN RUNOFF RESEARCH IN POLAND,**  
Research Inst. on Environmental Development,  
Warsaw (Poland)

For primary bibliographic entry see Field 2A.  
W78-07691

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN NORWAY,**  
Norges Vassdrags- og Elektrisitetsvesen, Oslo.  
Hydrological Div.

For primary bibliographic entry see Field 2A.  
W78-07693

# URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN THE UNITED KINGDOM

Institute of Hydrology, Wallingford (England).  
For primary bibliographic entry see Field 2A.  
W78-07698

### 5E. Ultimate Disposal Of Wastes

### THE EFFECTS OF DIURNAL MIXING ON THERMAL STRATIFICATION OF STATIC IMPOUNDMENTS.

For primary bibliographic entry see Field 2H.  
W78-07210

**NITROGEN TRANSFORMATIONS IN LAND TREATMENT,**  
Massachusetts Univ., Amherst. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5B.  
W78-07216

**MAKE WASTEWATER MORE VERSATILE:  
REUSE IT FOR RECREATION LAKES,**  
Oklahoma State Univ., Stillwater, Dept. of Civil

**POLLUTION IN THE NORTHEAST PACIFIC OCEAN.**  
National Marine Fisheries Service, Seattle, WA.  
Northwest and Alaska Fisheries Center.  
For primary bibliographic entry see Field 5B.  
W78-07325

**DATA REPORT--MARSH/POND SYSTEM,**  
Brookhaven National Lab., Upton, NY. Dept. of  
Applied Science.

For primary bibliographic entry see Field 5D.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Ultimate Disposal Of Wastes—Group 5E

W78-07338

**URANIUM-ISOTOPE VARIATIONS IN GROUNDWATERS OF THE FLORIDAN AQUIFER AND BOULDER ZONE OF SOUTH FLORIDA,**  
Florida State Univ., Tallahassee. Dept. of Geology and Geological Survey, Tallahassee, FL. Water Resources Div.  
For primary bibliographic entry see Field 5B.  
W78-07343

**THE USE OF GALERKIN FINITE-ELEMENT METHODS TO SOLVE MASS-TRANSPORT EQUATIONS,**  
Geological Survey, Denver, CO. Water Resources Div.  
For primary bibliographic entry see Field 5B.  
W78-07354

**ALUM TREATMENT OF HIGH-RATE TRICKLING FILTER EFFLUENT AT CHAPEL HILL, NORTH CAROLINA,**  
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.  
For primary bibliographic entry see Field 5D.  
W78-07409

**GRP PIPE FOR SEWAGE DISCHARGE AT SEA.**  
For primary bibliographic entry see Field 8G.  
W78-07415

**WASTEWATER EFFLUENT LINE SERVES DUAL PURPOSE,**  
Brownsville Public Utilities Board, TX.  
H. Fowler, and R. G. MacLennan.  
Public Works, Vol. 109, No. 4, p 58-60, April, 1978. 2 fig.

Descriptors: \*Pipelines, \*Concrete pipes, \*Outfall sewers, \*Irrigation water, \*Return flow, Outlets, Pipes, Pressure head, Pressure conduits, Cofferdams, Waste water treatment, Municipal wastes.

A 2.7 mile-long pipeline transports treated effluent from the Brownville, Texas, waste water treatment plant and provides irrigation water for sorghum and cotton crops. The 36-inch diameter, low-pressure reinforced concrete pipe has a design capacity of 20 mgd and is capable of withstanding a pressure head of 60 ft of water. The treated effluent, with a BOD and suspended solids concentration of 20 mg/liter, is discharged through the pipeline to the Rio Grande River. The discharge point in the Rio Grande, which was moved 2.8 miles downstream from the original outfall to prevent contamination at a raw water intake station, contains a riprap system and a cofferdam. Three irrigation taps located along the pipeline supply more than 50% of the 1,000 gpm of effluent as supplementary irrigation water during dry periods. Due to the instability of the soil in which the pipeline was laid, cement-stabilized sand was used to backfill the installation site. The project cost \$616,800 and was completed in 8 months. (Lisk-FIRL)  
W78-07419

**SLUDGE DISPOSAL: THE PROBLEM, THE SEARCH, THE SOLUTION,**  
Rickel Mfg. Corp., Kansas City, MO.  
For primary bibliographic entry see Field 5D.  
W78-07424

**TREATMENT AND USE OF SEWAGE PURIFICATION PLANT SLUDGES,**  
Didier (J. M.) and Associates, Brussels (Belgium).  
For primary bibliographic entry see Field 5D.  
W78-07425

**EFFLUENT TREATMENT PLANT FOR THE SMALLER COMMUNITY,**  
Hudson (Robert (Raletux) Ltd., Leeds (England).  
For primary bibliographic entry see Field 5D.  
W78-07428

**WASTEWATER SYSTEM PROVIDES NEW WATER SOURCE FOR ST. PETERSBURG.**  
For primary bibliographic entry see Field 5D.  
W78-07432

**THE THICKENING AND CENTRIFUGING OF SLUDGE,**  
For primary bibliographic entry see Field 5D.  
W78-07436

**HEAT TREATMENT AND PRESSING OF DIGESTED SLUDGE,**  
For primary bibliographic entry see Field 5D.  
W78-07437

**THE PRODUCTION OF PROTEIN FROM MUNICIPAL SLUDGE,**  
Utah Univ., Salt Lake City. Dept. of Chemical Engineering.  
For primary bibliographic entry see Field 5D.  
W78-07447

**LOS ANGELES FACES SEVERAL SLUDGE MANAGEMENT PROBLEMS,**  
Los Angeles Orange County Metropolitan Whittier, CA.  
For primary bibliographic entry see Field 5D.  
W78-07448

**PLANTS AND SYSTEMS FOR COMPOSTING OF SEWAGE SLUDGES IN THE FEDERAL REPUBLIC OF GERMANY—STATE OF THE ART AND TRENDS (ANLAGEN UND SYSTEME ZUR KOMPOSTIERUNG VON ABWASSERSCHLAEMMEN IN DER BUNDESREPUBLIK DEUTSCHLAND—STAND SOWIE TENDENZEN),**  
Umweltbundesamt, Berlin (West Germany).  
R. Mach.  
Muell and Abfall, Vol. 10, No. 1, p 1-9, 1978. 5 fig, 3 tab, 17 ref.

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Fertilizers, Municipal wastes, \*Degradation, Monitoring, Operation and maintenance, Reviews, Foreign countries, Europe, Biological treatment, Waste water treatment, Waste water disposal.

The current status and recent trends in sewage sludge composting in West Germany are reviewed. About 30 composting plants currently in operation in West Germany process sewage sludge alone without municipal refuse. Further increases can be expected in the adoption of sludge composting in view of the steady increase in the number of municipal waste water treatment plants and their associated sludge disposal problems. Composting in rows with or without additives (peat, lime, sawdust, manure, and mushroom mycelium) continues to be of little significance because of the high space requirement, the poor controllability, and the weather dependence of the composting process. Sludge composting in bioreactors is favored because of the small space requirement and ease of process control by monitoring temperature and carbon dioxide concentrations. The patented Kneer system is the most commonly used type of bioreactor in West Germany. Kneer bioreactors produce fresh compost in 2 weeks, providing for temperatures of 60-85C during the composting process. (Takacs-FIRL)  
W78-07449

**MEDICALLY USED RADIONUCLIDES IN SEWAGE SLUDGE,**  
Lund Univ. (Sweden); and Lund Inst. of Tech. (Sweden). Dept. of Nuclear Physics.  
For primary bibliographic entry see Field 5A.  
W78-07460

**MEASURING PETROLEUM HYDROCARBONS IN DIGESTED SEWAGE SLUDGES,**  
Canada Centre for Inland Waters, Burlington (Ontario).  
For primary bibliographic entry see Field 5A.  
W78-07462

**SUBMISSION BY THE INSTITUTE OF WATER POLLUTION CONTROL TO THE ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION ON 'ENVIRONMENTAL POLLUTION AND AGRICULTURE'.**  
For primary bibliographic entry see Field 5B.  
W78-07473

**NATURAL SEWAGE RECYCLING SYSTEMS**  
Brookhaven Nation Lab., Upton, NY. Dept. of Applied Science.  
For primary bibliographic entry see Field 5D.  
W78-07515

**RECLAMATION OF WASTEWATER BY APPLICATION ON LAND,**  
Cold Regions Research and Engineering Lab., Hanover, NH.  
For primary bibliographic entry see Field 5D.  
W78-07519

**RATE OF AMMONIUM NITRIFICATION AND NITRATE LEACHING IN SOIL COLUMNS,**  
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5B.  
W78-07520

**POLLUTION CONTROL IN THE BALTIC IS RESULT OF COOPERATION.**  
For primary bibliographic entry see Field 5G.  
W78-07528

**MARINE WASTE DISPOSAL IN THE NEW YORK BIGHT—PUBLIC POLICY, ENVIRONMENTAL IMPACTS, AND ALTERNATIVE FUTURES,**  
National Association of Regional Councils, Washington, DC.  
M. L. Italiano.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 222. Price codes: A13 in paper copy, A01 in microfiche. Report MLI-76/1, March 1976. 288 p, 6 fig, 10 tab, 156 ref, 4 append.

Descriptors: \*Sludge disposal, \*Waste water disposal, \*New York Bight, \*Environmental effects, \*Benthic fauna, Estuaries, Ocean currents, Coasts, Oceanography, Sedimentation, Dredging, Municipal wastes, Water quality control.

The environmental impact of municipal waste and sewage sludge disposal by barge transport to the 2,500 sq mile coastal area off New York City, New York, is evaluated. Barge disposal of dredged materials has been conducted since 1888; municipal waste dumping is now allowed by permits issued by the Environmental Protection Agency. Sediments in the sludge and dredge disposal sites contain increased levels of heavy metals, organic materials, and petrochemicals; both the sediments and the water in the disposal area have elevated coliform bacteria counts. Dissolved oxygen concentrations have decreased and turbidity has increased; benthic organisms are significantly different at the disposal site than in the surrounding

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5E—Ultimate Disposal Of Wastes

area. An alternative to disposal of municipal wastes and dredged materials in the coastal apex is land disposal of digested sludge. Diked disposal or incineration of dewatered sludge are also considered. (Lisk-FIRL)  
W78-07529

#### POLISH/U.S. SYMPOSIUM ON WASTEWATER TREATMENT AND SLUDGE DISPOSAL: VOLUME II.

Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.  
For primary bibliographic entry see Field 5D.  
W78-07530

**SUB-SEALED DISPOSAL OF RADIOACTIVE WASTE: PREVENTION OR MANAGEMENT,** Woods Hole Oceanographic Institution, MA. Marine Policy and Ocean Management Program. D. A. Deese.  
Technical Report No. WHOI-77-71, December 1977. 438 p, 14 fig, 6 tab, 271 ref, 2 append. SG-04-7-158-44104 ERDA-EY-77-S-02-4172-A000.

Descriptors: \*Waste disposal, \*Radioactive waste disposal, \*Water pollution sources, \*Water quality, Legal aspects, Political aspects, International law, \*Sub-sealed disposal, \*Environmental protection, Pollution prevention.

The technical, legal, political, and managerial elements of nuclear energy especially radioactive waste management, are analyzed to the degree necessary to provide background and perspective for understanding the sub-sealed disposal concept. Attention is focused on the new attitudes toward protecting the marine environment, especially on the emerging trend of phasing out disposal posing danger to man or the environment. The legal and political elements of the possible sub-sealed disposal of radioactive wastes in the U.S., other countries, and international organizations are investigated. Related domestic legal postures of the U.S. and several other nations with nuclear energy programs are analyzed and a detailed consideration of the international legal situation surrounding sub-sealed disposal is included. The existing and projected political responses to sub-sealed disposal from the U.S., other countries, and the related international organizations are discussed. Some ethical questions are outlined and evaluated, and finally the future of institutional possibilities for the management and prevention of sub-sealed disposal are analyzed separately. (NOAA)  
W78-07536

#### ENVIRONMENTAL MANAGEMENT OF A SHIP CHANNEL-HARBOR COMPLEX,

Texas A and M Univ., College Station. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5B.  
W78-07539

#### TECHNICAL AND PHILOSOPHICAL ASPECTS OF OCEAN DISPOSAL,

Texas A and M Univ., College Station. Dept. of Civil Engineering.  
M. C. Zaparka, and R. W. Hann, Jr.  
Texas A and M University Sea Grant Program Report No. TAMU-SG-78-203, November 1977. 170 p, 15 fig, 14 tab, 112 ref. 04-6-158-44012.

Descriptors: \*Waste disposal, \*Water pollution sources, \*Legislation, \*Water pollution effects, Sewer outfalls, Environmental effects, United States, \*Outer Continental Shelf, Ocean dumping, Environmental legislation.

Seven major technical aspects of ocean disposal are discussed in this report. They include qualitative and quantitative aspects of waste materials, disposal methods, transport of materials through water, effects of wastes, legislation, regulations,

criteria, quantities, disposal sites, alternatives to ocean disposal, and future trends of this disposal method. Twenty-two philosophies relating to ocean disposal are discussed, and relationships between technical aspects and philosophies are shown in figures. This report aims to serve as a reference for educational, governmental, industrial, and decision-making bodies. (NOAA)  
W78-07540

#### WATER QUALITY. MESA NEW YORK BIGHT ATLAS MONOGRAPH 27,

MESA New York Bight Project, Office, Albany.  
For primary bibliographic entry see Field 5B.  
W78-07542

#### INDUSTRIAL WASTES, MESA NEW YORK BIGHT ATLAS MONOGRAPH 30,

New York Sea Grant Inst., Albany.  
For primary bibliographic entry see Field 5B.  
W78-07547

#### THE 1973 BATHYMETRIC SURVEY IN THE NEW YORK BIGHT APEX: MAPS AND GEOLOGICAL IMPLICATIONS,

National Oceanic and Atmospheric Administration, Boulder, CO. Marine Ecosystems Analysis Program Office.  
For primary bibliographic entry see Field 2L.  
W78-07548

#### SURFACE CURRENTS AS DETERMINED BY DRIFT CARD RELEASES OVER THE CONTINENTAL SHELF OFF CENTRAL AND SOUTHERN CALIFORNIA,

National Marine Fisheries Services, Seattle, WA.  
For primary bibliographic entry see Field 5B.  
W78-07556

#### A MULTI-STAGE FILTER BELT PRESS.

Water Services, Vol. 81, No. 975, p 282, May, 1977. 1 fig.

Descriptors: \*Filters, \*Dewatering, \*Separation techniques, \*Sewage sludge, \*Pressure, Filtration, Construction materials, Design data, Sludge, Waste water treatment, Municipal wastes.

A four-stage filter belt press process for sludge dewatering, manufactured by Ames Crosta Babcock Ltd of Heywood, Lancashire, England, is constructed of modular units, permitting design customizing for various sludge types. The first stage of the dewatering system utilizes a series of gravity dewatering pockets arranged in a long or short configuration. The second stage presses the sludge between two belts arranged as a wedge. Further pressure is applied in the third stage; the sludge is pressed between belts which are passed over and under a series of drums or rollers. Continuous pressure is exerted on the sludge in the fourth stage by spring loaded plates. The dewatering system, available with belt widths of 1.0, 2.0, or 3.0 m, is designed for continuous operation. Dry solids contents of mixed primary and humus sludges have been increased from 4% to 35% by the filter belt system. (Lisk-FIRL)  
W78-07666

#### CONTAINMENT AREA MANAGEMENT TO PROMOTE NATURAL DEWATERING OF FINE-GRAINED DREDGED MATERIAL,

Army Engineer Waterways Experiment Station, Vicksburg, MS.  
M. J. Bartos, Jr.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 514. Price codes: A05 in paper copy, A01 in microfiche. Technical Report D-77-19, October 1977. 86 p, 30 fig, 6 tab, 18 ref.

Descriptors: \*Dewatering dredging, \*Containment areas, \*Dredged material, Fine grained soils.

Containment area management is reviewed, to promote natural dewatering of fine-grained dredged material. Interviews with personnel of several Corps of Engineers (CE) Districts and visits to dredged material containment areas showed that little is being done to dewater fine-grained dredged material confined on land. Based on information gained during the preliminary phase of the study and on current research results, four general guidelines for containment area management were formulated. The first guideline is concerned with the separation of sand and gravel from the fine material during the dredging operation. Surface water management is the subject of the second guideline. Guideline 3 presents concepts for optimizing evaporative dewatering by scheduling dredging before hot, dry weather, by placing dredged material in lifts not greater than 0.3 meter thick, and by using vegetation to transpire water from the dredged material. Alternative methods are the subject of the fourth guideline and include electro-osmosis, vacuum well points, and underdrainage. (WES)  
W78-07673

#### SIZING OF CONTAINMENT AREAS FOR DREDGED MATERIAL,

Massachusetts Inst. of Tech., Cambridge, MA. Constructed Facilities Div.  
S. M. Lacasse, W. T. Lambe, and W. A. Marr.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A050 038. Price codes: A09 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-21, October 1977. 192 p, 2 append, 16 tab, 74 fig, 25 ref.

Descriptors: Dimensions, Size, Sediments, Soil tests, \*Sizing, Sites, \*Containment areas, \*Dredged material, \*Waste disposal sites.

A rational method to size dredged material containment areas and guidelines for selecting the parameters required by the method are presented. The technique aims at improving the bulking factor sizing method presently in use and takes into account (a) the properties of the channel sediment to be dredged, (b) the behavior of the dredged material in the disposal site, and (c) the components of the dredging operation that affect volume of sediment dredged. For these purposes, current practice was surveyed, pertinent values of the dredging operation were reviewed, the behavior of several types of dredged material was investigated, and the prediction methodology was applied to four field cases. The major unknown in the method is the void ratio of the dredged material in the containment area. Laboratory sedimentation tests on channel sediment help predict void ratio versus depth and time in dredged material. (WES)  
W78-07674

#### SOLIDS DEWATERING.

Water Services, Vol. 81, No. 975, p 289, May, 1977.

Descriptors: \*Sludge treatment, \*Dewatering, \*Filters, \*Pressure, \*Filtration, Industrial wastes, Domestic wastes, Pulp wastes, Pilot plants, Waste water treatment, Sewage sludge, Municipal wastes.

A mobile sludge dewatering belt filter press, developed by Whitehead and Poole of England, has produced adequate dry solids contents in pilot tests performed at the Newthorpe works of the English Severn Trent Water Authority. The mobile pilot plant has a design capacity of 8.25 cu m/hr mixed primary and humus sludge. The belt filter press effectively dewatered a sludge flow of 10-13 cu m/hr to a final dry solids content within standard limits. The mobile unit was in operation in waste water treatment plants, water purification plants, and industrial waste facilities over a 12-



month testing period. The belt filter press was effective in industrial liquid-solid separation tests and was capable of efficiently dewatering combined domestic and paper mill waste streams. Further tests will be conducted to examine the feasibility of dewatering other mixed waste sludges. (Lisk-FIRL)  
W78-07675

**PATTERNS OF SUCCESSION IN BENTHIC IN-FAUNAL COMMUNITIES FOLLOWING DREDGING AND DREDGED MATERIAL DISPOSAL IN MONTEREY BAY,**  
Moss Landing Marine Lab. CA.  
For primary bibliographic entry see Field 5C.  
W78-07677

**IDENTIFICATION OF ALTERNATIVE POWER SOURCES FOR DREDGED MATERIAL PROCESSING OPERATIONS,**  
Civil Engineering Lab. (Navy), Port Hueneme, CA.  
For primary bibliographic entry see Field 8C.  
W78-07680

**AN EVALUATION OF OIL AND GREASE CONTAMINATION ASSOCIATED WITH DREDGED MATERIAL CONTAINMENT AREAS.**  
Engineering-Science, Inc., Austin, TX.  
For primary bibliographic entry see Field 5G.  
W78-07681

**FEASIBILITY OF INLAND DISPOSAL OF DEWATERED DREDGED MATERIAL: A LITERATURE REVIEW.**  
SCS Engineers, Long Beach, CA.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A048 203. Price codes: A08 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-33, November 1977. 153 p, 9 fig, 10 tab, 77 ref.  
Descriptors: Solid wastes, Dewatering, Reviews, Literature reviews, Dredged material disposal, Waste disposal sites, Site selection, Inland disposal sites.

Results are presented from an investigation of the feasibility of inland disposal of dewatered dredged material. The engineering, economic, social, and institutional factors associated with this method are identified and summarized in the report. The study is basically a thorough literature review of municipal and industrial solid waste management practices supplemented with specific information on dredged material. A comprehensive checklist is included that is meant to be used as a decision-making tool by officials who must provide inland sites for the final disposal of dredged material. The checklist presents a step-by-step planning process for the site selection and final site use. The primary findings are that inland disposal of dredged material is feasible and that the sites can be designed and operated in a manner which is environmentally sound and socially compatible. However, minor operational problems may be encountered which can only be identified following some field testing of the criteria. Also, there is as yet insufficient data available concerning the quality and quantity of leachate expected from land-deposited dredged material to enable an accurate engineering design of control systems. (WES)  
W78-07682

**GROUNDWATER TRACING WITH POST SAMPLING ACTIVATION ANALYSIS USING BROMIDE AND IODIDE IONS INJECTED SIMULTANEOUSLY INTO A SHALLOW-WELL SYSTEM.**  
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.  
For primary bibliographic entry see Field 5B.

W78-07683

## 5F. Water Treatment and Quality Alteration

**DETOXIFICATION OF STAPHYLOCOCCAL-ENTEROTOXIN B IN WATER (IN GERMAN),**  
Wehrwiss. Dienststelle Buntstelle Bundeswehr ABC-Schutz, Muenster (West Germany).  
G. Meyer, J. Hinterberger, and R. Korte.  
Aentralbl Bakteriell Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Betriebshyg Praev Med 164(4), p 352-359, 1977.

Descriptors: \*Staphylococcal-enterotoxin B, Detoxification, Water treatment, \*Calcium hypochlorite, Disinfectants, Macaca-mulatta.

Staphylococcal enterotoxin B (SEB) contaminated water was detoxified with calcium hypochlorite used in the water treatment procedure to obtain drinking water from surface water in emergency cases. Changes in toxin-activity were measured serologically by agar-gel-immunoprecipitation and biologically by monkey-feeding test with young Macaca mulatta. That an initial concentration of 50 ppm Cl resulted in the inactivation of toxin up to 40-fold average emetic dose for rhesus monkey. A correlation between precipitation test and monkey-feeding test was indicated. The clinical efficiency of SEB on rhesus monkeys was investigated and discussed subsequently.---Copyright 1978, Biological Abstracts, Inc.  
W78-07232

**TREATMENT OF WATER TO REMOVE CERTAIN IONS THEREFROM,**  
K. V. Zadera.  
U.S. Patent No. 4,059,513, 9 p, 3 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 4, p 1259-1260, November 22, 1977.

Descriptors: \*Patents, \*Water treatment, \*Water softening, \*Demineralization, Water purification, Separation techniques, Chemical precipitation, \*Sulfates, Calcium.

High sulfate content water is treated in a multistage process to remove sulfate and hardness. Sulfate concentration is reduced in the first stage of the process by the addition of calcium hydroxide. Calcium concentration is reduced in the second stage of the process by reaction of carbon dioxide or bicarbonate and calcium and hydroxide ions from the first stage of the process, forming insoluble calcium carbonate. The waste products of the demineralizing are in a form of slurry of low or insoluble salts, which facilitates easy disposal. (Sinha-OEIS)  
W78-07246

**APPARATUS FOR PURIFYING WATER,**  
Iodinamics Corp., El Paso, TX. (Assignee).  
R. D. Polley, E. L. Nilson, R. Constantakis, and D. E. Pruitt.  
U.S. Patent No. 4,059,522, 6 p, 4 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 964, No. 4, p 1263, November 22, 1977.

Descriptors: \*Patents, \*Water treatment, \*Water purification, \*Iodine, Water pollution treatment, Water quality control, Equipment, Disinfection, Flow, Venturi tube.

A water purification apparatus comprises a fitting for installation in a water line having a Venturi tube positioned in the primary water flow path. A secondary water flow path is established between the primary water flow path at either end of the Venturi tube and the inlet of a tank connected to the fitting. A metering valve is placed in the secondary water flow path upstream of the tank. A container is housed in the tank having an inlet connected with the tank and an outlet connecting with

the primary water flow path. The container holds a bed of iodine crystals which form a concentrated solution in the container. The Venturi creates a differential forcing a small portion of the water in the water line to flow through the tank. This water passes up through the bed of iodine crystals in the container and water containing iodine in dissolved form is returned to the water line and diluted to the desired concentration. Because of its design and the materials utilized, the apparatus can be shipped with the bed of iodine crystals inserted at the factory as opposed to shipping the iodine separately and filling the apparatus on site. The apparatus is self-proportioning and the concentration of iodine in the water can be controlled with great accuracy. (Sinha-OEIS)  
W78-07251

**STABILITY IN DRINKING AND SURFACE WATER OF NINE VIRUS SPECIES FROM DIFFERENT GENERA (IN GERMAN),**  
Institut fuer Medizinische Mikrobiologische Infekt.-Seuchenmed., Munich (West Germany).  
For primary bibliographic entry see Field 5C.  
W78-07272

**TOTAL ORGANIC HALOGEN AS WATER QUALITY PARAMETER: ADSORPTION/MICROCOULOMETRIC METHOD,**  
North Texas State Univ., Denton. Inst. of Applied Sciences; and North Texas State Univ., Denton. Dept. of Chemistry.  
For primary bibliographic entry see Field 5A.  
W78-07273

**PARTICLE DISRUPTION IN FLOCCULATING SYSTEMS,**  
Missouri Univ.-Columbia. Dept. of Chemical Engineering.  
R. H. Luecke, and L. A. Glasgow.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 793. Price codes: A02 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, Rolla, Completion Report, April 1978. 14 p, 1 fig, 2 tab, 3 ref. OWRT A-092-MO(1), 14-34-0001-6026, 7053 and 7054.

Descriptors: \*Water treatment, \*Polymer coagulant, Sedimentation, Flocc, Deaggregation, Particles, Coagulation, Flocculation, Polymers, Colloids, Separation techniques, \*Waste water treatment.

The deaggregation of floc formed using an organic polymer coagulant was studied in turbulent systems. The results could be correlated for a shear process that eroded small and primary particles from the floc surface. A large-scale fragmentation process was also documented and appears to a collisional mechanism. Further characterization of the large-scale fragmentation process is needed.  
W78-07321

**CONCENTRATION OF ENTEROVIRUSES FROM LARGE VOLUMES OF TAP WATER, TREATED SEWAGE, AND SEAWATER,**  
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.  
C. P. Gerba, S. R. Farrar, S. M. Goyal, C. Wallis, and J. L. Melnick.  
Applied and Environmental Microbiology, Vol. 35, No. 3, p 540-548, March, 1978. 3 fig, 4 tab, 31 ref.

Descriptors: \*Viruses, \*Filters, \*Potable water, \*Sewage, \*Sea water, Adsorption, Flocculation, Construction materials, \*Filtration, Separation techniques, Waste water treatment, Municipal wastes, \*Water treatment.

Fiberglass depth cartridges in series with pleated epoxy-fiberglass filters were evaluated as adsorption media for the concentration of enteroviruses

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5F—Water Treatment and Quality Alteration

from treated waste water, tap water, and sea water. The filter adsorption-elution method of virus recovery was tested with 10 inch filters having capacities up to 10 gal/min. The sample water containing the virus was acidified to pH 3.5 and mixed with aluminum chloride. After adsorption on the filters, the virus was eluted with one to five filter washings with 1,600 ml of glycine adjusted to pH 10.5. The viral eluates were neutralized before reconcentration with aluminum flocculation and hydroextraction. The virus recovery rates were: 52% from tap water, 53% from sea water, and 50% from secondary treated sewage. Nearly all the virus was extracted from sewage solids in tests with virus adsorbed on activated sludge. In further tests, the laboratory batch procedure recovered a maximum of 80% of the virus, compared to 82% for an in-line acid-salt injection method. (Lisk-FIRL)

W78-07463

#### WATER/WASTEWATER GUIDELINES.

Construction Engineering Research Lab. (Army),  
Champaign, IL.  
For primary bibliographic entry see Field 5A.  
W78-07522

#### VIRION AGGREGATION AND DISINFECTION OF WATER VIRUSES BY BROMINE.

North Carolina Univ. at Chapel Hill. Dept. of Bacteriology.  
D. G. Sharp.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 087.  
Price codes: A03 in paper copy, A01 in microfiche.  
Report EPA-600/2-76-163, May 1976. 43 p., 14 fig., 19 ref.

Descriptors: \*Viruses, \*Disinfection, \*Bromine, \*Electron microscopy, \*Analytical techniques, Pollutant identification, Infection, Microorganisms, Viricides, Water pollution sources, Waste water treatment.

Bromine disinfection of viruses was evaluated with aqueous solutions containing single particle or aggregated suspensions of polio virus and reovirus. Quantitative analysis of single particle reovirus and polio virus was performed by electron microscopy. Disinfection of the single particles by bromine required the development of a special apparatus to accommodate the exposure times, 0.05 sec in some cases, required for virus inactivation. First order reactions of both viruses with bromine were observed and equated as linear, semi-log graphs. Poliovirus inactivation occurred at a rate of 6 log units/min; reovirus infectivity declined at a rate of 3 log units/min. Single polio virus disinfection with 10 micromoles of bromine was twice as rapid at 10C than at 2C and more rapid at 20C than at 10C. Single reovirus was inactivated 30 times faster than poliovirus. Aggregated viruses had a significant effect on the disinfection kinetics of bromine. Slightly aggregated reovirus displayed a continuous reaction rate decline that deviated from the first order reaction. Other experiments with aggregated reovirus disinfection by bromine demonstrated that single reovirus was 200 times more sensitive to bromine treatment than aggregated reovirus, which survived for up to four minutes with the same bromine dose that inactivated single reovirus within 1-1/3 sec. (Lisk-FIRL)

W78-07524

#### INSTRUMENTATION AND AUTOMATION IN WATER AND WASTEWATER TREATMENT.

Philips Environmental Protection, Eindhoven (Netherlands).  
For primary bibliographic entry see Field 5A.  
W78-07525

#### EUROPEAN WATER TREATMENT PRACTICES AND WHAT WE CAN LEARN FROM THEM.

Public Technology, Inc., Washington, DC.  
G. W. Miller, and R. G. Rice.  
Civil Engineering-ASCE, Vol. 47, No. 11, p 46-49, November, 1977. 1 fig, 10 ref.

Descriptors: \*Potable water, \*Water treatment, \*Ozone, \*Activated carbon, \*Organic compounds, Chlorination, Filtration, Europe, Bacteria, Disinfection, Chlorine dioxide, Taste.

Of the different approaches to reducing trihalomethanes in finished U.S. drinking water, the use of disinfectants other than chlorine is being given little serious consideration at this time. Consequently, a sound alternative is to remove or reduce organics in the water before applying chlorine, an art many European cities have been practicing for years. Ozone, chlorine dioxide and activated carbon all can be used for this purpose, in spite of American technology's habitual view of these steps as disinfection rather than treatment processes. European water treatment philosophies and case studies of treatment procedures for several different European cities are discussed. The combination of preozonation followed by activated carbon treatment in Germany is particularly worth noting in that the removal of organics by the ozone prior to filtration extends the life of granular activated carbon columns to 2-3 years without requiring regeneration. (Eberle-NWWA)

W78-07604

### 5G. Water Quality Control

#### WATER QUALITY MODEL FOR THE UPPER NORTH PLATTE RIVER.

Wyoming Univ., Laramie. Water Resources Research Inst.  
For primary bibliographic entry see Field 5B.  
W78-07206

#### NITRIFICATION AND NITROGEN REMOVAL.

Corning Glass Works, NY.  
For primary bibliographic entry see Field 5D.  
W78-07215

#### INNOVATIVE MANAGEMENT CONCEPT FOR 208 PLANNING.

Michigan Univ., Ann Arbor. Dept. of Civil Engineering.  
J. W. Bulkley, and T. A. Gross.  
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. WR2, p 227-240, November 1977. 4 fig, 16 ref. OWRT A-083-MICH(2).

Descriptors: \*Water pollution, \*Management, \*Planning, \*Regional analysis, Evaluation, River basins, Thames Water Authority (Great Britain), Water services, Regional flood, Federal laws.

The Federal Water Pollution Control Act Amendments of 1972 establish area-wide (208) water quality planning requirements. Integral to 208 planning is the determination of a management structure to implement the plan. Criteria are presented to assist in the evaluation of alternative management structures. The recent development in England and Wales of regional water authorities is offered as one example of an innovative water management structure. It may offer useful information for 208 management structure planning currently underway throughout the United States. (Bell-Cornell)

W78-07222

#### TIDAL MARSH BIBLIOGRAPHY, SELECTED KEY WORK INDEX (PARTIALLY AN- NOTATED).

Delaware Univ., Newark. Coll. of Marine Studies.

For primary bibliographic entry see Field 2L.  
W78-07226

#### CONCENTRATORS FOR RECOVERING LIQUID POLLUTANT FLOATING ON THE SURFACE OF A SHEET OF WATER.

J. Vidiles.  
U.S. Patent No. 4,057,498, 10 p., 15 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 2, p 570, November 8, 1977.

Descriptors: \*Patents, \*Oil pollution, \*Water pollution treatment, \*Oil spills, Oil-water interfaces, Trawling, Water quality control, Separation techniques, Concentrators, Containment.

This invention relates to the recovery of liquid pollutants floating on the surface of water. It is possible to use a method similar to that used for trawling for fish in which the pollutant is removed from the surface of the water during trawling. A concentrator is provided which comprises a duct of flexible material having an inlet orifice parallel to the surface of the water and at least one outlet orifice for the outflow of the liquid pollutant from the concentrator. A suitable opening has a width greater than its height, the opening being situated as close as possible to the water line. In practice, the opening is preferably situated just below a float, which in general is only slightly immersed. Both trawling speed and the distance between traction means for trawling the concentrator can be varied. It is desirable that material of the slick should not escape below the skirt of the concentrator, which could occur after a certain period if this outlet were unable to remove all the material. It is therefore necessary for the height of this outlet to be greater than the thickness of the slick. (Sinha-OEIS)

W78-07233

#### OIL POLLUTION MONITORING AND MONITORING UNIT.

Bailey Meters and Controls Ltd. (England). (Assignee).  
For primary bibliographic entry see Field 5A.  
W78-07234

#### OIL SALVAGE SHIP WITH OCEAN GOING BOW.

T. I. Gaw.  
U.S. Patent No. 4,058,461, 5 p., 8 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 3, p 899, November 15, 1977.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, \*Water pollution treatment, Water quality control, Ships, Skimming, Separation techniques.

A principal object of this invention is to provide a ship having a specifically designed bow that opens up at the water level to admit oil from the water surface and collect it within tanks for transportation away. The ship includes a doorway at the water level for admitting oil and surface water as the ship moves ahead, and which is pumped into settling tanks. The bow has two hinged doors behind which is a rearwardly converging vestibule or scoop. In operative use, the ship cruises at a low rate of speed. Heading into the spill, the scoop will pick up oil and water and concentrate them in tanks. The tanks are allowed to settle for one or two hours after which the water is separated from the oil and pumped out of the tanks through overboard discharge pipes. (Sinha-OEIS)

W78-07239

#### CONTAMINATING SPILL DETECTION AR- RANGEMENT.

For primary bibliographic entry see Field 5A.  
W78-07241

PROCESS FOR  
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Betz Lab., In  
For primary  
W78-07248

#### DEVICE FOR SUBSTANCE FACE.

Ballast Ne  
(Netherlands)  
C. G. Middel  
U.S. Patent  
Gazette of  
964, No. 4, p

Descriptors:  
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#### BENTHIC GROWTH MENTS.

J.R. Mayer  
U.S. Patent  
Gazette of  
964, No. 2,

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W78-07257

Water Quality Control—Group 5G

PROCESS FOR CLARIFICATION OF OIL-CONTAINING WASTE,

Betz Lab., Inc., Trevose, PA. (Assignee).  
For primary bibliographic entry see Field 5D.  
W78-07248

DEVICE FOR COLLECTING LIGHT-WEIGHT SUBSTANCES FLOATING ON A LIQUID SURFACE,

Ballast Nedam Groep N.V., Amstelveen (Netherlands). (Assignee).  
C.G. Middelbeek.  
U.S. Patent No. 4,059,526, 4 p, 6 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 964, No 4, p 1265, November 22, 1977.

Descriptors: \*Patents, \*Oil pollution, \*Water quality control, Water pollution control, Water pollution treatment, Jets, Equipment, \*Separation techniques, Fluid jets.

A device for collecting light-weight substance floating on a liquid, for example, oil floating on water, comprises at least one accumulator tank for the oil to be collected, at least one downwardly extending wall of which extends as far as into the liquid and a jet nozzle for producing at least one downward stream. The device is characterized by a guide connected by its top ends with the jet nozzle, extending beyond the jet nozzle inside the jet and extending by its lower ends into the liquid, guiding the fluid jet above the light-weight substance along its outer sides, and being arranged at a distance from the downwardly extending wall. The adhering effect of the guide bar is improved when it has an angular profile. The jet adheres to the outer side of the guide so that the other surface of the jet is more tightly closed. In the event of wind the risk of disintegration of the fluid jet is small.  
W78-07253

BENTHIC SEMI-BARRIER TO CONTROL THE GROWTH OF WEEDS IN AQUATIC ENVIRONMENTS,

J.R. Mayer.  
U.S. Patent No. 4,056,936, 4 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 964, No. 2, p 380, November 8, 1977.

Descriptors: \*Patents, \*Water quality control, \*Aquatic weeds, \*Aquatic weed control, Screens, Aesthetics, Light penetration, Recreation.

Many bodies of water, especially warm, shallow lakes and reservoirs, most of which are important economically and aesthetically, are today beset with problems related both directly and indirectly to extensive and uncontrolled weed growth. Many of these bodies receive untreated or inadequately treated waste water. Further many lakes and rivers receive additional nutrient and trace chemical contributions from agricultural and industrial sources. Taken together, these cultural environmental stresses have produced explosive biological growth, particularly in the summer, thus interfering with boating, fishing, swimming, water skiing, and enjoyment of these aquatic resources. A principal objective of this invention is to provide an uncomplicated and inexpensive means for retarding and deterring weed growth. A screen of foraminous material is laid directly on the surface of shallow water beds where weed growth is likely or is occurring. The screen is non-reactive to the surrounding water and creates a physical semi-barrier to rootlet and stem formation and to transmission of light to the area to thereby retard germination and growth of weeds but not to stop growth entirely. The screen is formed with sufficient openings so that the normal movement of the surrounding water is not materially affected. (Sinha-EIS)  
W78-07257

VIRUSES IN WATER: THE INCREASING URGENCY OF THE PROBLEM AND APPROACHES TO ITS SOLUTION (IN RUSSIAN),

J. Melnick, C. Gerba, and C. Wallis.  
Vestn Akad Med Nauk Sssr 6, p 70-75, 1977.

Descriptors: \*Viruses, \*Mollusks, Enteroviruses, \*Water quality standards, Lethal limit, Water pollution control, \*Virus removal(Water), Waste water treatment.

Viral contamination of water and of mollusks has become an urgent problem. Aspects of the detection of pathogenic human enteroviruses in water, the setting of standards for their permissible concentrations, and physical and chemical methods for their removal or inactivation are discussed. Further studies will hopefully result in the development and acceptance of water standards incorporating criteria for virus levels.—Copyright 1978, Biological Abstracts, Inc.  
W78-07261

NUISANCE-ALGAE CONTROL THROUGH MECHANICAL HARVESTING,

California Univ., Berkeley. Sanitary Engineering Research Lab.  
B. L. Koopman, and W. J. Oswald.  
Water and Sewage Works, Vol. 124, No. 7, p 64-65, July 1977.

Descriptors: \*Algal control, \*Harvesting of algae, \*Mechanical control, \*Eutrophication, \*Water quality control, \*Equipment, \*Apparatus, Clear Lake(CA), California, Algae, Lakes, Impoundments, Aphaniizomenon, Pediastrum, Melosira, Microcystis, Cyanophyta, Nuisance algae.

A mechanical surface skimmer harvesting system for removing nuisance algae in eutrophic lakes is described, and results of its use on Clear Lake, California are presented. The device employs a submerged horizontal skim lip to lift a thin prism of water to an aluminum shroud, which directs the water over a screen assembly to a scavenger pump. The screen allows some water to escape. A continuously backwashed rotary microstrainer, used for secondary concentration, is mounted on the barge which pushes the skimmer. The barge's rear compartment holds 750 liters of algal slurry. An electrical generator and backwash stream pump are also located on the barge, which is propelled by a four-hp outboard motor. The skim lip is positioned at the extreme forward end of the unit to avoid interference from the bow wave formed by the polymer float which supports the skimmer. Thickness of the intercepted water prism is controlled by vertical adjustment via the depth control wheels. In field tests good skimming performance was achieved throughout the speed range. With the blank skimmer screen in place, the delivery ratio (DR) was 0.6 at a skimming depth of 2.5 cm, and 0.8 at a depth of 7.6 cm; the DR is the ratio of chlorophyll-a or dry weight in the delivery stream to that in the lake water column. Aphaniizomenon, Pediastrum, and Melosira showed concentration factors of 42, 47, and 75 with the coarsest fabric. (Lynch-Wisconsin)  
W78-07266

MICROBIOLOGICAL ASPECTS OF POLLUTION AND SELF-PURIFICATION OF THE WATER OF THE RIVER DANUBE ON ITS CZECHOSLOVAK SECTION (IN GERMAN),

Vyskumny Ustav Onkologicky, Bratislava (Czechoslovakia).  
For primary bibliographic entry see Field 5C.  
W78-07267

MERCURY POLLUTION OF WATER (IN BULGARIAN),

Academy of Medicine, Sofia (Bulgaria). Inst. of Hygiene and Occupational Diseases; and Academy of Medicine, Sofia (Bulgaria). Inst. of Nutrition.  
For primary bibliographic entry see Field 5B.

W78-07268

RESTORATION OF LOWER ST. REGIS LAKE (FRANKLIN COUNTY, NEW YORK),

New York State Dept. of Health, Albany. Environmental Health Center.  
G. W. Fuhs, and S. P. Allen.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 278, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/3-77-021, February 1977, 107 p, 37 fig, 24 tab, 50 ref. 1BA031, EPA R-801529.

Descriptors: \*Eutrophication, \*Rehabilitation, \*Lower St. Regis Lake(NY), \*Sewage treatment, \*Nutrient removal, \*Water quality control, New York, Lakes, Land use, Phosphates, Nitrogen, Limiting factors, Algae, Cyanophyta, Iron, Water pollution control, Diversion, Sediments, Dissolved oxygen, Data collections, Phosphorus.

Diversion of sewage effluent to eliminate phosphate inputs resulted in substantial water quality recovery in severely-eutrophic lower St. Regis Lake in Franklin County, New York. Ferric chloride was added and ferric phosphate sludge was removed July-December 1972, March-November 1973, and April 1974. Diversion to sand beds 250 m from the lake was begun May 1977, improving phosphorus removal from 80% during the summer to 100% year-round. Bioassay showed phosphate as the only limiting nutrient in spite of severe nitrogen depletion. During 1972-73, the first two years of curtailment of sewage phosphorus input, recovery was noticeable but consisted mostly of delaying the rise of the annual cyanophyte bloom to the surface; previously the bloom lasted all summer. During summer 1975 objectionable algal growth was limited to a three-week period. It is concluded that: (1) The lake's high iron content appears to be hastening recovery, but continued hypolimnetic oxygen depletion (probably from methane formation in sediments) is deterring recovery. (2) Year-round diversion is probably the most efficient alternative in small installations located in areas with severe winters. (3) Phosphate should be the target of control efforts in eutrophic freshwater lakes where phosphate is limiting, or nitrogen is limiting but nitrogen-fixing algae are or may become present. (Lynch-Wisconsin)  
W78-07291

ROLE OF HIGHER AQUATIC VEGETATION IN THE ACCUMULATION OF ORGANIC AND BIOGENIC SUBSTANCES IN INLAND WATERS,

Akademiya Nauk URSS, Kiev. Inst. Hidrobiologii.  
For primary bibliographic entry see Field 5C.  
W78-07294

WATER HYACINTHS AND ALLIGATOR WEEDS FOR FINAL FILTRATION OF SEWAGE,

National Space Technology Labs., Bay Saint Louis, MS.  
For primary bibliographic entry see Field 5D.  
W78-07299

NEW SYSTEM CUTS PHOSPHORUS FOR LESS COST,

Union Carbide Corp., Tonawanda, NY. Environmental Systems Dept.  
For primary bibliographic entry see Field 5D.  
W78-07301

THE PROBLEM OF THE SALINITY INCREASE IN LAKE QARUN (EGYPT) AND A PROPOSED SOLUTION,

Alexandria Inst. of Oceanography Fisheries (Egypt).  
For primary bibliographic entry see Field 5C.  
W78-07305



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

#### PHYSICAL-CHEMICAL METHODS FOR THE CONTROL OF ALGAL SPECIES AND COMPOSITION IN ALGAL CULTURING FACILITIES.

Delaware Univ., Newark. Coll. of Marine Studies; Delaware Univ., Lewes. Marine Studies Complex. R. F. Srna, A. Baggeley, and W. Page. Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 784. Price codes: A03 in paper copy, A01 in microfiche. Delaware Sea Grant Technology Report DEL-SG-8-76, 28 p., 16 fig., 1 tab., 9 ref. \$2.00. 1976. NOAA04-3-158-30.

Descriptors: \*Algal control, \*Limiting factors, \*Mechanical control, \*Species composition, \*Aquaculture, \*Nutrients, Foods, Algae, Clams, Oysters, Phaeodactylum tricornutum, Thalassiosira pseudonana, Carteria chuii, Ultrasonic waves.

Three methods are described for selective growth of the alga *Thalassiosira pseudonana* (desirable food for commercial culture of the hard clam and American oyster) and elimination or control of the undesirable alga *Phaeodactylum tricornutum*. (1) Ultrasonic waves, because of differences in cell wall composition, destroys *P. tricornutum* but does not harm *T. pseudonana*. (2) Addition of silicate, a limiting nutrient for *T. pseudonana*, can either eliminate or control the proportion of *P. tricornutum*. (3) A continuous seeding process can be used to take advantage of the faster growth rate of *T. pseudonana*. The methodology can be integrated into a two-loop culturing process: (1) One loop consists of a seed culture using a small amount of influent water and a larger mass algae culture. (2) The mass algae loop is continuously inoculated with sufficient new seed from the seed loop to ensure that *T. pseudonana* will out-compete other species. (3) Ultrasonic treatment is used on water entering the seed loop to eliminate *P. tricornutum*. The hard clam (*Mercentaria mercenaria*) and American oyster (*Crassostrea virginica*) require particular species of microalgae in sufficient quantities (as high as one billion cells/animal / day) to achieve rapid growth rates; *T. pseudonana*, used alone, yields good growth rates. (Lynch-Wisconsin)

W78-07324

#### ANALYSIS OF VARIOUS IOWA WATERS FOR SELECTED PESTICIDES: ATRAZINE, DDE, AND DIELDRIN--1974.

Atomic Energy Commission, Ames, IA. For primary bibliographic entry see Field 5A.

W78-07331

#### GAMMA RAY TREATMENT REAPS HARVEST FROM SEWAGE.

For primary bibliographic entry see Field 5D.

W78-07333

#### DETECTION OF NONPOINT POLLUTION OF SMALL STREAMS IN SOUTHWESTERN CONNECTICUT.

Fairfield Univ., CT. Dept. of Biology. For primary bibliographic entry see Field 5A.

W78-07334

#### URBAN RUNOFF POLLUTION CONTROL--STATE-OF-THE-ART.

Meta Systems Inc., Cambridge, MA. J. Kuhner, and M. Shapiro. Journal of the Environmental Engineering Division of the American Society of Civil Engineers, Vol. 102, No. 1, February 1976, p 220-223. 5 fig., 29 ref.

Descriptors: \*Urban runoff, \*Water pollution control, \*Model studies, SWMM model, STORM model, Storm runoff, Planning, Cost-effectiveness, Nonpoint pollution, Street cleaning, Reviews.

This discussion of Field and Lager's earlier paper on urban runoff control focuses on runoff models, selection of treatment alternatives, and management of nonpoint pollution sources. The problem of designing suitable sampling strategies in monitoring storm water quantity and quality has been neglected. Runoff models, such as EPA's SWMM, use dust and dirt accumulation rates as basic inputs, but these are not well established as parameters. Pertinent questions are whether or not dust and dirt accumulate linearly with time during the dry period, which flow conditions should be set in receiving waters for quality impact analysis, and which averaging conditions (runoff event, week, month, or year) should be introduced for determining necessary treatment facility efficiency. A combination of STORM (a continuous runoff model) with SWMM (usable only for single storms) would allow examination of continuous records of storm, water body flow, and antecedent dry weather conditions. While cost-effectiveness is a major criterion for selection of control and treatment alternatives, institutional, legal, and political factors must also be considered. Adjustment of street cleaning frequency appears to be the only promising control measure for controlling dirt accumulation, a major nonpoint source of pollution. (Lynch-Wisconsin)

W78-07335

#### EVALUATION OF THE COST-EFFECTIVENESS OF NONSTRUCTURAL POLLUTION CONTROLS: A MANUAL FOR WATER QUALITY MANAGEMENT PLANNING.

CONSAD Research Corp., Pittsburgh, PA. F. Rueter, and C. Fox, Jr. Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 513. Price codes: A05 in paper copy, A01 in microfiche. Prepared for U.S. Environmental Protection Agency, Planning Assistance Branch, Water Planning Division, Washington, D.C. April 30, 1976. 79 p., 56 ref.

Descriptors: \*Water management (Applied), \*Water pollution control, \*Non-structural alternatives, \*Cost effectiveness, \*Cost comparisons, \*Planning, Water quality control, Economics, Manuals, Methodology, Alternative costs, Land use, Legal aspects, Social aspects, Taxes, Pricing, Cost-benefit analysis, Property values.

A procedure is given for evaluating cost-effective implementation of nonstructural pollution controls for various aspects of land use. Included are technical measures such as vegetative stabilization and runoff diversion, and regulatory approaches to induce use of these technical measures. Non-structural alternatives can be used instead of or as a complement to structural measures, which comprise pollutant-reduction facilities. The cost-effectiveness analysis is applicable primarily to regulatory rather than technical approaches. It is assumed that a regulation specifies a performance requirement, such as a runoff level, but that the choice of the most cost-effective method of compliance is left to the regulated entity. In evaluating nonstructural cost-effectiveness, an indirect procedure must be employed which involves estimating such factors as market-value changes of affected properties, private administrative costs, and public monitoring costs. The handbook covers: (1) legal feasibility of nonstructural controls; (2) cost-effectiveness evaluation (including private costs and benefits, social costs and benefits, public and private administrative costs, and measurement of property value changes); (3) social impact assessment; and (4) equity aspects and the feasibility of alternative compensatory mechanisms. (Lynch-Wisconsin)

W78-07336

#### NITRIFICATION IN FOUR ACIDIC STREAMS IN SOUTHERN NEW JERSEY.

Geological Survey, Trenton, NJ. Water Resources Div.

For primary bibliographic entry see Field 5C.

W78-07353

#### ANALYSIS OF WASTE-LOAD ASSIMILATIVE CAPACITY OF THE YAMPA RIVER, STEAMBOAT SPRINGS TO HAYDEN, ROUTT COUNTY, COLORADO.

Geological Survey, Lakewood, CO. Water Resources Div., and Colorado Department of Health, Denver. For primary bibliographic entry see Field 5B.

W78-07356

#### PROTONATION OF ORGANIC BASES IN CLAY-WATER SYSTEMS.

Environmental Research Lab., Athens, GA. For primary bibliographic entry see Field 5B.

W78-07364

#### EFFECTS OF WETTING AGENTS ON WATER INFILTRATION INTO WATER-REPELLENT COAL MINE SPOILS.

Texas A and M Univ., El Paso. Research Center. S. Miyamoto. Soil Science, Vol. 125, No. 3, p 184-187, 1978, 3 tab., 9 ref.

Descriptors: \*Surfactants, \*Wetting, \*Strip mine wastes, \*Infiltration, \*Sulfonates, Spoil banks, Revegetation, Ethers, Alcohols, Effects, Coal mines, Repellent, Water repellent material.

Improved water infiltration may enhance revegetation of water repellent coal mine spoils. Commercially available wetting agents, therefore, were studied for their effect on increasing infiltration. The tested wetting agents included linear sulfonate (anionic), alkyl polyethylene glycol ether (nonionic), and ethoxylated alcohol (nonionic) compounds. The infiltration tests were performed under greenhouse conditions for soil as well as water applied wetting agents. Results indicated that in both cases the sulfonate compound, but not necessarily the other, improves infiltration. (Visocky-ISWS)

W78-07370

#### ECONOMIC IMPACT OF WATER QUALITY ON RIVER BASIN MANAGEMENT.

California Univ., Davis. Dept. of Civil Engineering. O. J. Helwig, and D. Alvarez. Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 785. Price codes: A04 in paper copy, A01 in microfiche. California Water Resources Center, Davis. Completion Report, Contribution 168, March 1978. 61 p., 47 fig., 16 tab., 47 ref. (California Water Resources Center Project UCAL-WRC-W-517). OWRT A-060-CAL(2).

Descriptors: \*Groundwater, \*Irrigation, \*Water quality, \*Water costs, Irrigation practices, \*Economic impact, Saline water, Pricing, Water demand, \*California, \*San Luis River basin (Calif.), River basin management, Water pollution.

Groundwater quality degradation caused by irrigation affects as much as one-third of the irrigated area of the world. This problem is particularly insidious because the process is slow and hidden. A management tool called the Accelerated Salt Transport (ASTRAN) method has recently been proposed to help control groundwater degradation. The ASTRAN method distributes the different qualities of available irrigation water over the basin in a way that controls groundwater degradation at minimum cost. To implement the solution, the water supplier must give some irrigators poorer quality water than others. If water is sold merely by the quantity used, irrigators who receive the poor quality water will certainly object; consequently, the price of water should be determined by water quality as well as quantity.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

## Water Quality Control—Group 5G

This study investigated a way to price water quality and quantity by approximating its value with a derived demand surface. This value was then used to price the optimally distributed water. The data from the San Luis River Basin in Southern California were used to test the results which are presented in a series of figures along with a detailed description of the approach used. (Snyder-Calif, Davis)  
W78-07396

### AQUATIC USE PATTERN FOR DIQUAT FOR CONTROL OF EGERIA AND HYDRILLA.

Army Engineer Waterways Experiment Station, Vicksburg, MS.  
R. D. Blackburn, E. O. Gangstad, R. R. Yeo, N. Dechoretz, and P. A. Frank.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A034 202. Price codes: A08 in paper copy, A01 in microfiche. Technical Report No. 13, Army Corps of Engineers, Aquatic Plant Control Program, September 1976. 161 p, 37 fig, 50 tab, 28 ref, 6 append.

Descriptors: \*Aquatic weed control, \*Egeria densa, \*Hydrilla verticillata, \*Diquat, \*Herbicides, Aquatic Plant Control Program, U.S. Army Corps of Engineers, Chemcontrol, Navigable waters, Copper, Chickahominy Reservoir(VA), Walker Dam Impoundment(VA), Komine, K-lox, Endothall, Labels.

A summary of cooperative research from 1969-74 of the U.S. Army Corps of Engineers Aquatic Plant Control Program with three other institutions, focuses on use of the herbicide diquat for control of Egeria densa and Hydrilla verticillata. An introductory summation of findings is followed by research project reports in the appendices: (1) proposed label for diquat, with directions, cautions, and geographic areas of intended use by the corps; (2) efficacy and residues of diquat for egeria and hydrilla control; (3) greenhouse studies of reproduction and growth of egeria; (4) aquatic weed control in small reservoirs with diquat; and (5) final environmental statement for Walker Dam Impoundment. Conclusions: (1) Diquat and diquat plus copper effectively control egeria and hydrilla, though repeat applications are necessary for maintenance. (2) Diquat residues dissipate in 1-3 days. (3) The most efficient chemicals tested for control of egeria were diquat, komine, and combinations of diquat and komine or K-lox. (4) Diquat has been effective for weed control in small reservoirs, with treatment ranging from 0.25-1.5 ppmw; combinations with copper sulfate were successful, but must be used with caution to prevent fishkill. (5) At normal treatment levels no residues were found in crops irrigated with diquat. (6) Diquat and endothall were successfully used to control egeria in Chickahominy Reservoir. (See also W78-07400 thru W78-07403) (Lynch-Wisconsin)  
W78-07399

### EFFICACY AND RESIDUES OF DIQUAT APPLIED FOR CONTROL OF EGERIA AND HYDRILLA.

Agricultural Research Service, Fort Lauderdale, FL. Southern Region.  
R. D. Blackburn, and E. O. Gangstad.

Descriptors: \*Egeria densa, \*Hydrilla verticillata, \*Aquatic weed control, \*Pesticide residues, \*Diquat, \*Copper, Southern naiaid, Najas guadalupensis, Chemcontrol, Herbicides, Cutrine, Florida, Fish, Toxicity, Endothall, Hydrothol, Rates of application, Dispersion, Water pollution effects.

Laboratory, growth pool, and field experiments conducted over 10 years with diquat and other herbicides for control of Egeria densa, Hydrilla verticillata, and southern naiaid (Najas guadalupensis) indicate that several herbicides work well but must be repeated to maintain control. In egeria experi-

ments: (1) Excellent control was obtained with diquat plus 0.25 ppmw copper amine complex. (2) Other satisfactory control agents included endothall plus copper, diquat alone, and diquat plus endothall. (3) The amine salt of endothall was very effective for egeria control, but toxic to fish. (4) The controlled-release formulation of the amine salt of endothall was more effective and less toxic to fish than the regular formulation. (5) Copper at 2 ppmw gave partial control but was moderately toxic to fish and plant regrowth was relatively rapid. Hydrilla testing conducted in growth pools (with southern naiaid) and operational large-scale field tests, gave these results: (1) Most formulations of hydrothol were effective for control of both hydrilla and southern naiaid but was extremely toxic to fish, except for 2.0 ppmw slow-release pellets which gave 98-100% control with no fish mortality. (2) The toxicity of both diquat and endothall to hydrilla and southern naiaid was increased by the addition of copper, and neither was toxic to fish. Copper and diquat dissipated in water samples within 14 days, but inplant samples copper had not returned to pretreatment levels after 28 days. (See also W78-07399) (Lynch-Wisconsin)  
W78-07400

### GREENHOUSE STUDIES OF THE GROWTH AND REPRODUCTION OF EGERIA Densa.

University of Southwestern Louisiana. Lafayette.  
For primary bibliographic entry see Field 4A.  
W78-07401

### AQUATIC WEED CONTROL IN SMALL RESERVOIRS WITH DIQUAT.

Agricultural Research Service, Davis, CA.  
R. R. Yeo, N. Dechoretz, P. A. Frank, and E. O. Gangstad.

In: Appendix E, Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, Technical Report No. 13, Army Corps of Engineers, Aquatic Plant Control Program, September 1976. 27 p, 9 fig, 8 tab, 16 ref.

Descriptors: \*Diquat, \*Dicop, \*Herbicides, \*Aquatic weed control, \*Reservoirs, \*Pesticide residues, California, Fish, Submerged plants, Dispersion, Water pollution effects, Crops, Irrigation, Biocontrol, Chemcontrol, Competition, Alcop.

Six small California reservoirs were selected to study the effectiveness of mixtures of diquat plus copper sulfate pentahydrate (dicop) in controlling several varieties of submerged aquatic weeds and to assess toxicity of fish. All dicop treatments killed weed growth in the reservoirs; no fish showed stress except golden shiners, 50 of which were killed in one reservoir. Submerged weeds in the reservoirs included horned pondweed (Zannichellia palustris), curlyleaf pondweed (Potamogeton crispus), sago pondweed (P. pectinatus), water milfoil (Myriophyllum spicatum var exalbescent), American clodea (Elodea canadensis), coontail (Ceratophyllum demersum), California waterprimrose (Ludwigia peltoides), and chara (Chara spp). The diquat dissipated to near-nondetectable levels after about four days; two-thirds disappeared after one day. Grasses and crops irrigated with water containing diquat suffered no injury; no diquat was detected in the crops. The reservoirs were located at golf courses near Davis, West Sacramento, and Auburn, California. Dicop was applied at 100 ppb diquat plus 300 ppb copper ion by slowly pouring into the water from a boat. Alcop was applied at 500 ppb aliquat 4 plus 500 ppb copper ion. A general review of aquatic weed control methods is included. (See also W78-07399) (Lynch-Wisconsin)  
W78-07402

### FINAL ENVIRONMENTAL STATEMENT FOR WALKER DAM IMPOUNDMENT, AQUATIC

### PLANT CONTROL PROJECT, NEW KENT COUNTY, VIRGINIA.

Army Engineer District, Norfolk, VA.  
For primary bibliographic entry see Field 6G.  
W78-07403

### NATIONAL NEEDS FOR COMBINED SEWER OVERFLOW CONTROL.

Metcalf and Eddy, Inc., Boston, MA.  
For primary bibliographic entry see Field 5D.  
W78-07422

### OPERATING ACTIVATED-SLUDGE PLANTS TO EFFECT NUTRIENT REMOVAL.

For primary bibliographic entry see Field 5D.  
W78-07441

### HYACINTHS FOR WASTEWATER TREATMENT.

For primary bibliographic entry see Field 5D.  
W78-07442

### FUTURE TREATMENT PLANT REQUIREMENTS.

Durban City Engineers Dept. (South Africa).  
For primary bibliographic entry see Field 5D.  
W78-07474

### LANDMARK TEXAS DECISION AGREES BENEFIT IS NOT WORTH THE COST.

Dallas Water Utilities Dept., TX.  
T. E. Taylor.  
Water and Wastes Engineering, Vol. 15, No. 4, p 26-29, April, 1978. 2 fig.

Descriptors: Water quality standards, \*Water pollution control, \*Tertiary treatment, \*Treatment facilities, \*Biochemical oxygen demand, Water purification, Water quality, Texas, Costs, Suspended solids, Ammonia, Nitrogen, Waste water treatment, Municipal wastes.

The Texas Water Quality Board relaxed the standards for advanced treatment of waste water in response to hearings conducted in 1977. The Board had adopted waste water treatment standards of 5 mg/liter BOD, 5 mg/liter total suspended solids, and 3 mg/liter ammonia-nitrogen. Treatment facilities costing \$250 million were under construction in the Dallas and Fort Worth area to attain water quality standards of 10 mg/liter BOD and 10-15 mg/liter total suspended solids which were required by other Texas cities. These standards represented a 96% pollutant removal, whereas the more stringent regulations corresponded to 98% removal. Testimony during the hearing on the standards revealed that an additional \$100-600 million would be required to upgrade and maintain the treatment plants to meet the strict standards. Other reports indicated that the quality of the river receiving the treated effluent would not be significantly improved by the measures until other non-point pollution sources were controlled. The Board voted to accept the 10 mg/liter BOD and 15 mg/liter total suspended solids regulations. (Lisk-FRL)  
W78-07475

### IMPLEMENTING COST-EFFECTIVE POLLUTION CONTROL BY MEANS OF EFFLUENT CHARGES: AN EXAMPLE APPLIED TO ELECTROPLATING DISCHARGES.

Virginia Univ., Charlottesville.  
E. R. Saltzberg.  
Available from University Microfilms International, Ann Arbor, MI 48106; Order No. 78 00459. PhD Thesis, 1977. 205 p.

Descriptors: \*Mathematical models, \*Metals, \*Chemical wastes, \*Pollution taxes(Charges), Analytical techniques, Nitrogen, Effluents, Water quality standards, Simulation analysis, Waste water treatment, Industrial wastes.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Mathematical models are presented for the implementation of an industrial waste discharge tax dependent upon the types of pollutants discharged. The methodology is designed to incorporate the marginal pollution abatement schedules and costs of standard treatment methods instituted by individual industries. A comparison of simulated data with local effluent quality standards permits the evaluation of marginal abatement schedules when compared with actual sampled discharges and predicted pollutant loads. The mathematical models provide an accurate cost estimate procedure to be used by water quality monitoring agencies. The methodology is applied to the simulated abatement schedules of three hypothetical electroplating companies. The models effectively estimate the plants' operating costs; the results are used to devise a tax system charging for cyanide discharge, a dissolved metal content index, and pH variations. Pollution abatement practices by the electroplating industry can be enforced with a charge of \$4.35/lb of cyanide discharge and \$11/lb of dissolved metal discharge. (Lisk-FIRL) W78-07481

**DISTRIBUTION, GROWTH, AND PHOSPHORUS RELATIONSHIPS OF MYRIOPHYLLUM HETEROPHYLLUM MICHX. IN LAKE WINNIPESAUKEE, NEW HAMPSHIRE.**  
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.  
For primary bibliographic entry see Field 5C.  
W78-07482

**UNIFIED PRESENTATION OF WEIR-AERATION DATA.**  
Karlsruhe Univ. (West Germany). Inst. fuer Hydromechanik.  
For primary bibliographic entry see Field 2E.  
W78-07494

**THE DEVELOPMENT OF A HYDROPERM (TM) MICROFILTRATION SYSTEM FOR THE TREATMENT OF DOMESTIC WASTEWATER EFFLUENTS.**  
Hydronautics, Inc., Laurel, MD.  
For primary bibliographic entry see Field 5D.  
W78-07526

**POLLUTION CONTROL IN THE BALTIC IS RESULT OF COOPERATION.**  
Water and Wastes Engineering, Vol 15, No 4, p 23, April, 1978.

Descriptors: \*Water pollution control, \*Water quality standards, \*Sewage, \*Waste water disposal, Domestic wastes, Treatment facilities, Forcing countries, Industrial wastes, Farm wastes, Waste water treatment, Municipal wastes.

Baltic Sea countries have reached agreements on the control of pollution entering the sea from municipal and industrial sources. Inadequately treated municipal sewage, agricultural runoff, and wastes from paper, shale oil, and chemical industries are the primary sources of pollution in the Baltic Sea. Tallinn, Estonia, discharges domestic sewage directly into the Baltic without treatment; Leningrad, U.S.S.R., treats one-third of its sewage before discharge to the Bay of Finland. Regulations limiting the discharge of sewage containing BOD, nitrogen, and ammonia are based on the waste assimilative capacity of the receiving body of water. The establishment of biological and chemical secondary treatment facilities has been initiated. Industries in the Soviet Union are now required to remove carcinogens and other toxic materials from waste water before discharge to a water body of treatment facility. Removal of nitrogen, phosphorus, and fertilizers from agricultural runoff has been required by the Soviet Union; DDT has been banned. Water consumption has been reduced through reuse in industrial operations. (Lisk-FIRL)

W78-07528

**SUB-SEAED DISPOSAL OF RADIOACTIVE WASTE: PREVENTION OR MANAGEMENT.**  
Woods Hole Oceanographic Institution, MA. Marine Policy and Ocean Management Program.  
For primary bibliographic entry see Field 5E.  
W78-07536

**TECHNICAL AND PHILOSOPHICAL ASPECTS OF OCEAN DISPOSAL.**  
Texas A and M Univ., College Station. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5E.  
W78-07540

**ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL REPORTS SUMMARY FOR THE YEAR ENDING MARCH 1977.**  
Science Applications, Inc., Boulder, CO.  
For primary bibliographic entry see Field 6G.  
W78-07557

**FORMULATING STATE GROUNDWATER POLICY IN PENNSYLVANIA.**  
Pennsylvania Dept. of Environmental Resources, Harrisburg.  
C. W. Westlund.  
Water and Sewage Works, Vol. 125, No. 2, p 67-68, February, 1978.

Descriptors: \*Pennsylvania, \*Groundwater, Water pollution control, Water quality control, Pollution abatement, Legislation, Regulation, Administrative agencies, Management.

It is estimated that in Pennsylvania there are 47 trillion gall. of ground water 'storage'. Annual average precipitation in the state is 32 trillion gallons; precipitation and ground water discharge produce 21 trillion gallons of stream flow. Total stream flow for an average year is estimated to consist of 60 to 70 percent ground water discharge. The Clean Streams Law of Pennsylvania is the basis for ground water pollution control in the state, empowering its Department of Environmental Resources to implement a ground water quality protection program through the development of regulations. This program, which began in 1963 has continued to grow as environmental protection problems have become publicized. Today, 23 hydrogeologists are at work in different state departments dealing with industrial waste, solid waste management, and mine waste influences on ground water quality. Focusing upon both pollution abatement and pollution prevention, the ground water program staff provide both legal and technical assistance in cleanup projects, reviewing and investigating proposed waste disposal activities, and the development of guidelines, rules, regulations, and standards to maintain present ground water quality and prevent future instances of contamination. (Eberle-NWWA) W78-07576

**ARRESTMENT OF FUMES IN THE NON-FERROUS METALS INDUSTRY.**  
International Environmental Bureaux for the Non-Ferrous Metals Industries, Wantage (England). C. J. P. Steiner.  
Filtration and Separation, Vol. 15, No. 2, p 148, 150, 153, March-April, 1978. 1 fig, 8 ref.

Descriptors: \*Metals, \*Air pollution, \*Filters, \*Metallurgy, \*Melting, Aluminum, Copper, Aluminum, Lead, Fluorides, Zinc, Ammonium compounds, Venturi flumes, Waste water treatment, Industrial wastes.

Abatement techniques for various types of fumes produced in non-ferrous metal industries using fabric filtration are discussed. Fabric filters are

preferred over Venturi scrubbers and electrostatic precipitators for metal refinery fumes because a 99% recovery of micron size particles can be achieved without the need for further treatment of the particulates. Temperature control of the fumes is important to prevent scorching or clogging of the fabric filters. Fumes from brass melting, containing zinc oxide and lead oxide, must be thermally deoiled before bag filtration to prevent the formation of pyrophoric mixtures of carbon and zinc oxide. Secondary copper refining produces fumes containing zinc oxide and other metallic impurities which can be effectively removed by fabric filtration or high pressure Venturi scrubbers. Removal of chlorine and aluminum chloride, produced during secondary aluminum refining, is achieved more effectively by wet scrubbers; sodium chloride, produced during scrap melting, can be removed by bag filtration. A filtration method using an alumina-coated fabric bag removes 98% of the fluoride emissions produced during primary smelting of aluminum. Lead emission control can be maintained by large fabric filters or wetting procedures to within the limits of 11.5 -115 mg/cu m established for the varying size lead smelting and refining plants. Bag filtration is considered uneconomical in the reduction of ammonium chloride, zinc oxide, and zinc chloride produced by hot-dip galvanizing processes. (Lisk-FIRL) W78-07596

**PROCEEDINGS OF NATIONAL CONFERENCE: IRRIGATION RETURN FLOW QUALITY MANAGEMENT.**

Colorado State Univ., Fort Collins.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 068. Price codes: A08 in paper copy, A01 in microfiche. Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, May 16-19, 1977. 451 p, 193 fig, 136 tab, 310 ref, append. J. P. Law and G. V. Skogerboe, editors.

Descriptors: Irrigation, \*Irrigation systems, \*Irrigation practices, Crop production, Crop response, \*Return flow, Water quality, \*Water quality control, Model studies, Agriculture, Technology, \*Salinity, \*Fertilization, Groundwater, Runoff, Erosion, Sedimentation, Water resources, Water conservation, Irrigation efficiency, Water law, \*Water management (Applied), Pollutants, Pollution abatement, Pollutant identification.

The results of numerous research projects and investigations are presented which focus upon defining appropriate technologies for alleviating water quality problems from irrigated agriculture; most of these technologies involve improved water management practices. In addition, case studies are presented for key irrigated areas in the United States which provide necessary insights and experiences as to how technologies might be most effectively implemented. The primary objectives of the conference were: (1) to present the results of the irrigation return flow research and development program of the United States Environmental Protection Agency; (2) to interpret the research results into an interdisciplinary approach for solving problems of irrigation return flow quality management; and (3) to provide a forum for presenting and discussing the alternatives for implementing irrigation return flow quality control. (See W78-07607 thru W78-07654) (Skogerboe-Colorado State) W78-07606

**THE ROLE OF EPA'S OFFICE OF RESEARCH AND DEVELOPMENT IN IRRIGATED CROP PRODUCTION RESEARCH.**  
Environmental Research Lab., Ada, OK. Office of Research and Development.

J. P. Law, Jr., and A. G. Hornsby.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado

State University  
May 16/19, 1977

Descriptors: Water control, Water management, Research agencies, Waste water agencies.

In setting the the Irrigated was described 500 to EPA a to control water agricultural the program PL 92-500, an efforts of the represents a gram's effort direction the research has and evaluation tion abatement investigated h structural delivery, fa irrigated ag investigated t institutional reform. Mo Current which we research. I research-ba providing n agencies re ing areawid involving n (See also W W78-07607

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NITROGEN Texas Ag For primary W78-07610

**NITROGEN MINIMIZ FROM P BASIN,**  
Washington Agronom B. L. Mc In: Proc tion Retu State Un May 16-1

Descriptors: \*Return \*Potatoes nigation, Coopera dissolved



## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

State University, Fort Collins, Colorado, p 1-6, May 16-19, 1977. 1 fig.

Descriptors: \*Crop production, \*Water quality control, Water pollution, Irrigation, Irrigated land, Water management (Applied), Return flow, Research and development, Agricultural activities, Waste water management, \*Administrative agencies.

In setting the stage for the conference, the role of the Irrigated Crop Production research program was described. The legislative mandates of PL 92-500 to EPA are reviewed in relation to the charge to control water quality degradation resulting from agricultural activities. The overall objectives of the program, established prior to the passage of PL 92-500, appear to be valid and supportive of the efforts of the program thus far. This conference represents a compendium of the results of the program's efforts as well as a hard look at the future direction the program should take. Supported research has included technology development and evaluation of its effectiveness in water pollution abatement and/or control. The technology investigated has included both structural and non-structural improvements within the water delivery, farm, and water removal subsystems of irrigated agriculture. Additional studies have investigated the legal, socio-economic, and/or other institutional constraints to water management reform. More effort will be required in these areas. Current program emphasis is evolving into a phase which we are referring to as implementation research. Included in this is the preparation of research-based guidance documents aimed at providing much needed information for those state agencies responsible for planning and implementing areawide wastewater management alternatives involving nonpoint source agricultural activities. (See also W78-07606) (Skogerboe-Colorado State) W78-07607

#### SIMULATION OF NITROGEN MOVEMENT, TRANSFORMATIONS, AND PLANT UPTAKE IN THE ROOT ZONE.

Florida Univ., Gainesville. Dept. of Soil Science. For primary bibliographic entry see Field 5B. W78-07608

#### NITRATE MOVEMENT IN CLAY SOILS AND METHODS OF POLLUTION CONTROL.

Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences; and Texas Agricultural Experiment Station, College Station. For primary bibliographic entry see Field 5B. W78-07609

#### EFFECT OF THREE IRRIGATION SYSTEMS ON DISTRIBUTION OF FERTILIZER NITRATE NITROGEN IN SOIL.

Texas Agricultural Experiment Station, Lubbock. For primary bibliographic entry see Field 5B. W78-07610

#### NITROGEN AND WATER MANAGEMENT TO MINIMIZE RETURN-FLOW POLLUTION FROM POTATO FIELDS OF THE COLUMBIA BASIN.

Washington State Univ., Pullman. Dept. of Agronomy and Soils. B. L. McNeal, B. L. Carlile, and R. Kunkel. In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 33-43, May 16-19 1977. 7 tab, 7 ref.

Descriptors: \*Nitrogen, Fertilizers, Fertilization, \*Return flow, \*Water Management (Applied), \*Potatoes, \*Columbia River, Crop production, Irrigation, Sprinkler irrigation, Furrow irrigation.

Cooperative field studies have evaluated levels of dissolved soil N, and corresponding crop yields,

for selected potato production practices in the Columbia Basin area of Washington. High dissolved-N levels were found throughout the growing season in well-managed potato fields. Such levels were decreased by decreased fertilization rate, use of slow-release N fertilizers, or sprinkler-application of N fertilizers. Careful water management during sprinkler irrigation proved capable of maintaining dissolved-N within the furrow irrigation also proved effective in 'trapping' much banded fertilizer N within the plant root zone on heavier-textured furrow-irrigated soils. Periodic recovery of residual N by other crops in the rotation is necessary to prevent eventual return-flow contamination, however. Site-to-site sampling variability necessitated the use of composited soil samples, rather than fixed-position soil solution extraction cups, for adequate monitoring of dissolved-N levels in soils of the area. Neither dissolved soil N nor plant petiole NO<sub>3</sub>-N proved to be reliable predictors of crop N needs at the high residual soil N levels commonly found in recropped potato fields of the Columbia Basin. (See also W78-07606) (Skogerboe-Colorado State) W78-07611

#### VARIABILITY OF NITRATE LEACHING WITHIN DEFINED MANAGEMENT UNITS, California Univ., Riverside.

For primary bibliographic entry see Field 5B. W78-07612

#### FIELD MEASURED FLUX OF VOLATILE DENITRIFICATION PRODUCTS AS INFLUENCED BY SOIL WATER CONTENT AND ORGANIC CARBON SOURCE.

California Univ., Davis. Dept. of Land, Air and Water Resources. D. E. Rolston, D. A. Goldhamer, D. L. Hoffman, and D. W. Toy.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 55-61, May 16-19, 1977. 5 fig, 1 tab, 10 ref.

Descriptors: Irrigation, Soils, Soil investigations, Soil moisture, \*Return flow, Measurement, \*Denitrification, \*Soil water movement, \*Organic carbon.

The amount of NO<sub>3</sub> in irrigation return flow waters is dependent upon each of the components of the N cycle in soils. One of those components for which absolute amounts and rates are not well known is denitrification. Volatile denitrification products, primarily N<sub>2</sub>O and N<sub>2</sub>, are evolved whenever anoxic sites develop within the soil and when sufficient carbon is available. Absolute amounts and rates of denitrification from a Yolo loam field profile at Davis, California, were studied in relation to the influence of soilwater content and organic carbon source. Field plots were intensely instrumented with soil atmosphere samplers, soil solution samplers, and tensiometers. Soil-water pressure heads (h) in the upper 15 cm of soil were maintained constant at -15 and -70 cm of water. Three levels of soil carbon were evaluated from plots cropped with ryegrass, uncropped plots, and plots to which manure was mixed in the top 10 cm of soil. Fertilizer was applied at the rate of 300 kg N ha<sup>-1</sup> as KNO<sub>3</sub> enriched with 20 and 40 percent <sup>15</sup>N for the h = -15 and h = -70 cm treatments, respectively. The flux of volatile gases at the soil surface was measured from the accumulation of N<sub>2</sub>O and <sup>15</sup>N<sub>2</sub> beneath an airtight cover placed over the soil surface for 1 and 2 hours per day. Denitrification occurred in order of decreasing magnitude in manure (h = -15 cm), manure (h = -70 cm), uncropped (h = -15 cm), and uncropped (h = -70 cm) plots. Approximately 70 percent of the fertilizer nitrogen was denitrified for the manure (h = -15 cm) treatment. Approximately 1 percent of the added fertilizer was denitrified in the uncropped (h = -70 cm) treatment. (See also W78-07606) (Skogerboe-Colorado State) W78-07613

#### SOIL NITRATE CONCENTRATIONS IN CORN PLOTS TREATED WITH ISOTOPICALLY LABELED NITROGEN FERTILIZER.

California Univ., Davis. Dept. of Land, Air and Water Resources. For primary bibliographic entry see Field 5B. W78-07614

#### THEORETICAL AND EXPERIMENTAL OBSERVATIONS OF WATER AND NITRATE MOVEMENT BELOW A CROP ROOT ZONE.

California Univ., Davis. Dept. of Land, Air and Water Resources. For primary bibliographic entry see Field 5B. W78-07615

#### MINIMIZING SALT IN RETURN FLOW BY IMPROVING IRRIGATION EFFICIENCY.

Agricultural Research Service, Riverside, CA. Salinity Lab.

J. V. Schilfgaarde. In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 81-98, May 16-19, 1977. 19 fig, 4 tab, 24 ref.

Descriptors: Salinity, \*Saline water, Irrigation efficiency, Agriculture, \*Colorado river, Leaching, \*Arizona, \*Return flow.

Return flow from irrigated agriculture has been identified as the major source of salinity in the Colorado River that may be controlled. Thus, if the trend of increasing salinity is to be reversed, it appears that irrigated agriculture must bear a large portion of the burden. Research at the United States Salinity Laboratory indicates irrigated agriculture can reduce its contribution by efficient irrigation that provides water of low salinity in the upper portion of the crop root zone while the salinity of the water in the lower portion can be permitted to concentrate considerably more than had previously been suspected without decreased yields. If these results hold true under field conditions, the leaching requirement of most crops grown with Colorado River water could be reduced below 10%. Lower leaching requirements, if achieved, would also reduce salt discharge to the river due to precipitation of lime and gypsum in the soil and because of decreased salt pickup from saline underground sources. To evaluate the minimum leaching concept for alleviating the salinity problem of a major river basin, two field studies have been initiated in the Wellton-Mohawk Irrigation and Drainage District of southwestern Arizona. The first field experiment was installed in December 1973 in citrus on coarse-textured, valley soil. The paper describes the experimental design of both experiments and initial data on crop water use, soil salinity profiles, and leaching fractions achieved presented. (See also W78-07606) (Skogerboe-Colorado State) W78-07616

#### MODELING SALINITY OF IRRIGATION RETURN FLOW WHERE SOURCES AND SINKS ARE PRESENT.

Utah State Univ., Logan. Dept. of Soil Science and Biometeorology. For primary bibliographic entry see Field 5B. W78-07617

#### FIELD EVALUATION OF SPRINKLER IRRIGATION FOR MANAGEMENT OF IRRIGATION RETURN FLOW.

Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering. L. S. Willardson, and R. J. Hanks.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 109-114, May 16-19, 1977. 6 fig, 2 tab, 4 ref.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Descriptors: \*Salinity, Saline soils, Saline water, Irrigation, \*Utah, Leaching, \*Sprinkler irrigation, \*Return flow.

Sprinkler irrigation offers one alternative for control of irrigation water application that influences quality of return flow. A two-year field scale study of soil solution response to controlled water application using sprinklers was conducted in the Ashley Valley near Vernal, Utah. The design level of water control was attained with high coefficients of uniformity but the soil solution did not respond as expected. The soil acted both as a source and a sink for salt. Root zone salinity was only slightly affected by different leaching fractions. Minimum average leaching fractions obtainable are influenced by both the hydraulic design and operation of the system. (See also W78-07606) (Skogerboe-Colorado State) W78-07618

#### EFFECTS OF IRRIGATION MANAGEMENT ON SOIL SALINITY AND RETURN FLOW QUALITY

New Mexico State Univ., University Park. Dept. of Agronomy.

P. J. Wierenga, and J. B. Sisson.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 115-121, May 16-19, 1977. 3 fig, 3 tab, 12 ref.

Descriptors: Saline soils, Irrigation systems, \*Surface irrigation, Water quality, Groundwater, \*Irrigation efficiency, Soil water, \*Trickle irrigation, \*Return flow.

A field plot study was conducted to determine the effects of controlled surface irrigation and trickle irrigation on soil salinity, and on the quality and quantity of irrigation return flow. Changes in soil salinity were determined by taking extensive soil samples at least once a year. Return flow quality was measured on soil solution removed through vacuum samplers in the subsoil of each plot, and by analyzing the water quality at various levels below the groundwater and in a nearby drain. The quantity of return flow was estimated from crop growth and weather data, and amounts of water applied. This method was found more reliable than several other methods used for determining percolation losses. Results of the first three years of this ongoing study showed that a larger change in soil salinity was produced by altering irrigation frequency than by changing irrigation efficiency. Irrigating when 50 percent of the soil-water had been depleted was the irrigation frequency most conducive to salt retention in the upper soil profile. However, different irrigation efficiencies and frequencies had no significant effect on cotton yield due in part to the large spatial variability of the physical properties of the soil at the site. (See also W78-07606) (Skogerboe-Colorado State) W78-07619

#### EFFECT OF IRRIGATION SYSTEMS ON WATER USE EFFICIENCY AND SOIL WATER SOLUTE CONCENTRATIONS

Texas Agricultural Experiment Station, Lubbock. C. W. Wendt, A. B. Onken, O. C. Wilke, R. Hargrove, and W. Bausch.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 123-131, May 16-19, 1977. 9 tab, 8 ref.

Descriptors: \*Subsurface irrigation, Irrigation efficiency, \*Sprinkler irrigation, \*Furrow irrigation, \*Texas, Irrigation water, \*Return flow, Irrigation systems.

The effect of sprinkler irrigation (Sp), furrow irrigation (F), subirrigation (Su), and automated subirrigation (ASu) systems on water use efficiency and soil-water solute concentration was evaluated at a field site in Knox County, Texas. Significant

differences existed in the irrigation water requirement of sweet corn irrigated by the different systems ( $F > Sp$  approximately =  $Su > ASu$ ). However, little difference in total water requirement existed between systems -- the soil water was utilized more efficiently ( $ASu > Su$  approximately =  $Sp > F$ ). Automation of irrigation systems offers the possibility of significantly enhancing irrigation water use efficiency of supplemental irrigated areas. Soil-water solute concentrations were too low to be of concern relative to degrading the quality of irrigation return flow due to the dilution effect of rainfall. In most cases, at depths below 3.0 m, the concentrations of the above solutes in the soil were less than those of the irrigation water. Although soil-water solutes were not a problem in the irrigation return flows, the lower concentrations of the ASu and Su systems indicate that they may be superior to F and Sp systems in maintaining the quality of irrigation return flows where solutes are a problem. (See also W78-07606) (Skogerboe-Colorado State) W78-07620

#### SCIENTIFIC IRRIGATION SCHEDULING FOR SALINITY CONTROL OF IRRIGATION RETURN FLOW

Agricultural Research Service, Kimberly ID. Snake River Conservation Research Center. M. E. Jensen.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 133-139, May 16-19, 1977. 3 tab, 6 ref.

Descriptors: Model studies, \*Irrigation water, Leaching, \*Return flow, \*Irrigation efficiency, Evapotranspiration, \*Salinity.

Basic principles of irrigation water management and irrigation scheduling are presented. Commercial and agency groups expanded rapidly in the 1970's providing field-by-field scheduling services to over 600,000 acres in 1976. The leaching fraction used on projects can effect return flow quality. Most leaching fraction return flow models hypothetically assume uniform water applications of exact quantities to attain targeted leaching fractions. The average or effective leaching fraction for a field is dependent on the irrigation uniformity coefficient. The effects of nonuniform water application on average leaching fractions are presented, along with the probable effects of expected improvements in irrigation efficiency on return flow. Also, estimates of the accuracies in estimating evapotranspiration and measuring water are presented. Substantial improvements can be made in irrigation efficiencies before minimum leaching fractions are reached on most western irrigated projects. (See also W78-07606) (Skogerboe-Colorado State) W78-07621

#### MANAGEMENT GUIDELINES FOR CONTROLLING SEDIMENTS, NUTRIENTS, AND ADSORBED BIOCIDES IN IRRIGATION RETURN FLOWS

Cultural Research Service, Kimberly ID. Snake River Conservation Research Center. D. L. Carter, and J. A. Bondurant.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 143-152, May 16-19, 1977. 3 tab, 36 ref.

Descriptors: Furrow irrigation, \*Sediments, \*Return flow, \*Erosion, \*Nutrients, Surface irrigation, Runoff, Irrigation, Tailwater, Irrigation systems, Water management (Applied).

Sediments in irrigation return flows arise mostly from furrow erosion, and nearly all nutrients and biocides in surface irrigation return flows, except those applied directly to the water, are adsorbed to the sediments. Therefore, controlling erosion and sediment loss in these surface return flows also

controls the nutrients and biocides. There are three general management approaches for controlling sediments in return flows. The first is to eliminate surface runoff by using irrigation methods that produce no runoff. These methods include properly designed and operated sprinkler systems, basin, trickle, and some border and level furrow methods. The second approach is to eliminate or reduce erosion by controlling the slope in the direction of irrigation, the furrow stream size, the run length, the irrigation frequency and duration, and tillage practices. The third is to remove sediments from surface return flows by controlling the tailwater and utilizing sediment retention basins. All three approaches are applicable and necessary for adequate control in most irrigated areas. Available technology needs to be integrated and applied to these approaches. Research to develop improved irrigation systems and methods, improved irrigation water distribution systems, and better field management practices, and research on design and operational criteria for sediment retention basins are needed. (See also W78-07606) (Skogerboe-Colorado State) W78-07622

#### QUALITY OF IRRIGATION RETURN FLOW FROM FLOODED RICE PADDIES

California Univ., Davis. Dept. of Soil and Crop Sciences.

For primary bibliographic entry see Field 5B.

W78-07623

#### EVALUATION OF SURFACE IRRIGATION RETURN FLOWS IN THE CENTRAL VALLEY OF CALIFORNIA

California Univ., Davis. Dept. of Land, Air and Water Resources.

For primary bibliographic entry see Field 5B.

W78-07624

#### AN ECONOMIC ANALYSIS OF IRRIGATION RETURN FLOW RECYCLE SYSTEMS IN THE CENTRAL VALLEY OF CALIFORNIA

California Univ., Davis. Dept. of Agricultural Economics.

W. Kinney, G. L. Horner, and K. K. Tanji.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 175-182, May 16-19 1977. 2 tab, 6 ref, append.

Descriptors: \*Economics, \*Recycling, Irrigation districts, \*Return flow, \*California, \*Central Valley (Calif).

Irrigation return flow recycle systems have been used in California for a number of years under a variety of crop rotations, soil characteristics and qualities of irrigation water. Recycle systems operating on the field, farm and district level were compared on the basis of cost in two areas of the San Joaquin Valley. The effects of three scales of recycle systems on the least-cost combination of irrigation water delivery systems and water management techniques were evaluated. (See also W78-07606) (Skogerboe-Colorado State) W78-07625

#### ON-FARM METHOD FOR CONTROLLING SEDIMENT AND NUTRIENT LOSSES

Idaho Univ., Moscow. Dept. of Agricultural Engineering.

D. W. Fitzsimmons, C. E. Brockway, J. R. Busch, G. C. Lewis, and G. M. McMaster.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 183-191, May 16-19, 1977. 2 fig, 12 tab, 6 ref.

Descriptors: \*Sediments, \*Nutrients, \*Idaho, Irrigation, Irrigation water, Runoff, Return flow, Sediment yield, Beans, Phosphates, Irrigation practices.

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tion Retu...  
State Un...  
213, May

Descripti...  
Seepage...  
\*Return

Field experiments were conducted in the Boise and Magic Valley areas of southern Idaho during the 1975 and 1976 irrigation seasons to evaluate on-farm method for controlling sediment and nutrient losses from irrigated fields. In one experiment, four 1.7 ha plots of field corn were continuously monitored during the two irrigation seasons. Varying furrow stream sizes and stream cutback methods were used to apply the same total amounts of irrigation water to three of the plots. No control measures were used on the fourth plot. Runoff from two of the first three plots were run through a vegetated buffer strip at the lower end of the field and then a settling basin. Runoff from the other two plots were run through a basin only. The effects of each treatment and control measure on the quality and quantity of return flow from these plots are presented. The results of sediment and nutrient yield determinations on several other field sites in the two study areas are also presented. The effects of various combinations of soil types, crops, irrigation practices and sediment retention devices on sediment and nutrient losses from these sites were evaluated. (See also W78-07606) (Skogerboe-Colorado State) W78-07626

# **ECONOMIC ANALYSIS OF ON-FARM METHODS FOR CONTROLLING SEDIMENT AND NUTRIENT LOSSES,**

K. H. Lindeborg, L. Conklin, R. B. Long, and E. L. Michelson.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 193-201, May 16-19, 1977. 16 tab, 3 ref.

Descriptors: \*Economics, \*Nutrients, \*Sediments, \*Idaho, Model studies, Irrigation practices, Crop production, Erosion, Sedimentation, Irrigation, Water quality, Phosphorus, Nitrogen, Groundwater, Pollution.

Information from 150 farmers in the Boise and Magic Valley areas was collected relative to current crop production, tillage and irrigation practices, cost of production, and income from crop production. The physical and economic data were processed by a budget generating method allowing standardized procedures of estimating costs of operating machinery and equipment. Partial budgets for each important crop grown in the two areas were developed from the computer program. Representative farms were simulated for the two areas based on the partial budgets. The simulated farm sizes will be a measure of the profitability of the present farming operation under existig water management practices. The effects on farm net income of implementing erosion control practices on the farms, as well as by district, are analyzed using linear programming models. The analysis is based on two farm sizes in each area, and measures the effects on net farm income for a given set of rotation with increasing sedimentation loss, or alternately, a changing cropping pattern with a given lower limit of sediment loss with the resulting change in farm net income. (See also W78-07606) (Skogerboe-Colorado State) W78-07627

# **COMBINING AGRICULTURAL IMPROVEMENTS AND DESALTING OF RETURN FLOWS TO OPTIMIZE LOCAL SALINITY CONTROL POLICIES,**

Colorado State Univ., Fort Collins. Dept of Agricultural and Chemical Engineering.  
W. R. Walker.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 203-213, May 16-19 1977. 7 fig, 9 ref.

Descriptors: Model studies, Mathematical simulation, \*Desalination, Irrigation, \*Colorado, Seepage, \*Salinity control, \*Optimization, \*Return flow.

Mathematical simulations of the cost-effectiveness relationship for various agricultural and desalination alternatives for controlling salinity in irrigation return flows are being developed. The question of respective feasibility for each type of control is determined through minimizing the total costs, thereby optimally selecting the best measures to implement. To demonstrate the concept, desalting and canal linings were compared for the Grand Valley in western Colorado. Results indicate that desalting exhibits superior feasibility of linings of canals where seepage rates are low. In general, desalting will exhibit its best feasibility when applied to large-scale applications and when salt pickup rates stemming from irrigation return flows are small. (See also W78-07606) (Skogerboe-Colorado State) W78-07628

# **PRACTICAL APPLICATIONS OF IRRIGATION RETURN FLOW QUALITY MODELS TO LARGE ACREAGES,**

Bureau of Reclamation, Denver, CO. Engineering and Research Center.  
M. J. Shaffer, and R. W. Ribbens.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 217-223, May 16-19, 1977. 6 fig, 1 tab, 12 ref.

Descriptors: \*Model studies, \*Simulation analysis, Water quality, Water quality control, Irrigation, \*Return flow.

Numerous return flow quality simulation models have been developed in recent years. Practical use of these tools on large irrigation projects is discussed in terms of study objectives, data requirements and availability, model detail and sensitivity, inherent limitations, and reliability and interpretation of results. The modeling efforts of the Bureau of Reclamation and other institutions are used to illustrate the utility and practicability of these new tools. Potential and present model users should gain valuable insight into the benefits and pitfalls of return flow quality modeling. (See also W78-7606) (Skogerboe-Colorado State) W78-07629

# **AREAL PREDICTIONS OF SOIL WATER FLUX IN THE UNSATURATED ZONE,**

Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.  
For primary bibliographic entry see Field 2G.  
W78-07630

# **WATER DISTRIBUTION PATTERNS FOR SPRINKLER AND SURFACE IRRIGATION SYSTEMS,**

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.  
For primary bibliographic entry see Field 3F.  
W78-07631

# **HYDRO-SALINITY MODELS: SENSITIVITY TO INPUT VARIABLES,**

Agricultural Research Service, Riverside. Salinity Lab.  
For primary bibliographic entry see Field 5B.  
W78-07632

# **MODELING THE IRRIGATION RETURN FLOW SYSTEM—CURRENT CAPABILITIES AND FUTURE NEEDS,**

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.  
W. R. Walker.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 261-265, May 16-19, 1977.

Descriptors: \*Model studies, \*Simulation analysis, Water quality, Mathematical studies, \*Return flow.

A large number of mathematical models have been developed and tested for simulation of irrigation return flow systems. The strengths and weaknesses of the technology have been examined as part of two recent studies by the author. This paper discusses what seems to be some of the more critical problems in using these models, the relative strengths of those existing, and important research and development needs for maximizing their utilization in the future. (See also W78-07606) (Skogerboe-Colorado State) W78-07633

# **APPLICATION OF MODERN IRRIGATION TECHNOLOGY IN THE MESILLA VALLEY, NEW MEXICO,**

New Mexico State Univ., University Park. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 3C.  
W78-07634

# **ECONOMICS OF CONTROLLING IRRIGATION RETURN FLOW IN THE MESILLA VALLEY, NEW MEXICO,**

New Mexico State Univ., University Park.  
R. R. Lansford, L. W. Gelhar, and B. J. Creel.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 277-282, May 16-19, 1977. 4 fig, 1 tab, 6 ref.

Descriptors: \*Model studies, Water quality, Water management(Applied), Irrigation, Irrigation water, \*Return flow, \*Mesilla Valley(NMex), \*New Mexico, \*Economics.

Preliminary budgeting indicates that net returns of water are reduced by incorporation of irrigation water management practices, but that irrigation water requirements may be reduced. Thus, incorporation of these improved irrigation water management practices may be feasible under restricted water availability constraints. If irrigation water use can be reduced without affecting the local agricultural economy by optimal crop selection incorporating the improved practices, the quantity of irrigation return flows may be reduced and possibly the quality may be improved. Further evaluation in the current and last year of the three-year project will provide opportunities for refinements and sensitivity evaluation in the linear programming model as well as more extensive iterative analysis with the hydrological model. (See also W78-07606) (Skogerboe-Colorado State) W78-07635

# **AGRICULTURAL DRAINAGE PROBLEMS OF THE SAN JOAQUIN VALLEY,**

Bureau of Reclamation, Sacramento, CA. Mid-Pacific Regional Office.  
For primary bibliographic entry see Field 4A.  
W78-07636

# **HOW THE NPDES PROGRAM WILL DEFINE PRESENT WATER QUALITY CONDITIONS,**

Central Valley Regional Water Quality Control Board, Sacramento, CA.  
G. Merrill.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 289-291, May 16-19, 1977. 3 tab.

Descriptors: Surface irrigation, \*Return flow, \*California, Suspended solids, \*Irrigation, \*Water quality control, \*National Pollution Discharge Elimination System, \*San Joaquin(Calif).

Monitoring of surface irrigation supplies and surface return flows is being carried on through the



## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

National Pollution Discharge Elimination System (NPDES) permit program under Public Law 92-500. This program encompasses approximately 1.3 million acres of land in the San Joaquin Valley of California alone. The EC and suspended solids of the irrigation returns frequently exceed basin water quality control plan objectives (standards) adopted in 1971 by the Central Valley Board for the receiving water. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07637

#### LOCAL SOLUTIONS TO DRAINAGE PROBLEMS.

Westlands Water District, Fresno, CA.  
For primary bibliographic entry see Field 4A.  
W78-07638

#### A VALLEYWIDE SOLUTION—THE INTERAGENCY DRAINAGE PROGRAM.

San Joaquin Valley Interagency Drainage Program, Fresno, CA.  
For primary bibliographic entry see Field 4A.  
W78-07639

#### IRRIGATION RETURN FLOW PROBLEMS IN YAKIMA VALLEY.

Washington State Dept. of Ecology, Olympia. J. Spencer, and M. Horton.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 299-306, May 16-19 1977. 2 fig, 5 ref.

Descriptors: \*Return flow, Agriculture, Sediments, Phosphates, Nitrates, Water management(Applied), Water quality, Irrigation, Soils, \*Washington, \*Yakima Valley(Calif).

Studies completed in recent years show that irrigated agriculture is a significant source of the pollutants in the lower reaches of the Yakima River. Sediments, phosphates and nitrates are the principal pollutants resulting from irrigation activities. Improved on-farm water management practices should be undertaken to alleviate this water quality degradation. Since the passage of P.L. 92-500, attempts to apply NPDES permits to irrigation return flows have been stymied by legal questions and a lack of knowledge of relationships between farming practices, soils, weather conditions, and water quality. In addition, there are legal questions regarding the authority of irrigation districts in the State of Washington to control on-farm water management practices. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07640

#### THE SULPHUR CREEK PILOT PROJECT: A PRACTICAL APPROACH TO CONTROL OF POLLUTANTS LEAVING IRRIGATED FARMLANDS.

Washington State Dept. of Ecology, Olympia. J. Spencer, M. Horton, and J. Gleaton.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 307-319, May 16-19 1977. 2 fig, 1 tab.

Descriptors: \*Washington, \*Return flow, Water quality control, Fertilizers, Pesticides, Crop production, Irrigation, Economics, \*Sulfur Creek project(Wash).

The Sulphur Creek project grew out of the momentum and confusion resulting from attempts to apply a National Pollution Discharge Elimination System (NPDES) permit to irrigation return flows. The result has been a project containing what appeared to be compatible and, for the most part, admirable objectives -- soil and water conservation, improved water quality, improved fertilizers and pesticides application, improved crop production, and local control. Along with education and

technical assistance for the individual farmer, this unique program is structured to provide local control to decisions affecting the farmer. The Best Management Practices concepts assumes that informed decisions and improved management will generally provide improved crop production, conservation of soil resources, and cleaner water. The project is currently just over one year old. Details of the technical success of the project will not be available for some time. Unlike most types of industry covered by the NPDES permit, irrigation return flow improvement represents complex hurdles which have to be overcome by facing the realities of technology, politics, economics, and social patterns. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07641

#### THE '208' PLANNING EFFORT FOR IRRIGATED AGRICULTURE IN THE STATE OF WASHINGTON.

Washington State Dept. of Ecology, Olympia. M. Horton, and J. Spencer.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 321-323, May 16-19 1977. 1 fig.

Descriptors: \*Irrigation, Irrigation effects, \*Washington, \*Agriculture, Water quality control, Economics, Planning, Best management practices.

The Department of Ecology is responsible for developing a '208' Plan for irrigated agriculture in the State of Washington. It is anticipated that Best Management Practices (BMP) will be utilized by individuals to come into compliance with a statewide regulatory program (possibly NPDES). Water quality committees formed through local conservation districts, with representatives from all interested groups, will develop BMP based on the following criteria: (1) economic feasibility; (2) local acceptability; and (3) water quality improvement. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07642

#### THE 1973 AGREEMENT ON COLORADO RIVER SALINITY BETWEEN THE UNITED STATES AND MEXICO.

Colorado River Board of California, Los Angeles.  
For primary bibliographic entry see Field 6E.  
W78-07643

#### AN ASSESSMENT OF IRRIGATION EFFICIENCIES AND DRAINAGE RETURN FLOWS FROM THE WELLTON-MOHAWK DIVISION OF THE GILA PROJECT.

Bureau of Reclamation, Yuma, AZ. Yuma Projects Office.  
For primary bibliographic entry see Field 3C.  
W78-07644

#### WELLTON-MOHAWK ON-FARM SYSTEMS IMPROVEMENT PROGRAM.

Soil Conservation Service, Phoenix, AZ.  
For primary bibliographic entry see Field 3C.  
W78-07645

#### RESEARCH AND DEMONSTRATION APPROACH TO DEVELOPMENT OF APPROPRIATE SALINITY CONTROL TECHNOLOGIES FOR GRAND VALLEY.

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering. G. V. Skogerboe, and W. R. Walker.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 353-359, May 16-19 1977. 5 fig, 4 ref.

Introduction of channel seepage and irrigation percolation losses into the underlying soils and marine

aquifer, and the eventual return of these flows to the Colorado River with their large salt loads, make the Grand Valley in western Colorado one of the more significant salinity sources in the Upper Colorado River Basin. The Grand Valley Salinity Control Demonstration Project was formulated to delineate the magnitude of the water and salt flow components from the irrigation systems to evaluate the effectiveness of various water management technologies in reducing the salt load reaching the Colorado River, and to demonstrate appropriate technologies on farmers' fields. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07646

#### THE HYDRO-SALINITY SYSTEM IN THE GRAND VALLEY.

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering. W. R. Walker, G. V. Skogerboe, R. G. Evans, and S. W. Smith.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 361-367, May 16-19 1977. 7 fig, 3 tab, 13 ref.

Descriptors: Colorado, \*Colorado River Basin, \*Salinity, \*Salts, Groundwater, \*Return flow, Seepage, Deep percolation, \*Grand Valley(Colo).

The Grand Valley hydro-salinity system is described by research data collected over an eight-year period. A review of previous estimates indicates the great variability that can be expected when data are few and of poor quality. The Grand Valley system contributes approximately 630,000 metric tons of salts to the river annually. This figure represents 78 metric tons of salt per hectare-meter of water reaching the underlying groundwater aquifer from irrigation return flows with canal and ditch seepage contributing 23 percent of the salt pickup, lateral seepage 32 percent, and on-farm head ditch seepage and deep percolation losses contributing the remaining 45 percent of the salt pickup. (See also W78-07606) (Skogerboe-Colorado State)  
W78-07647

#### MODELING SALT TRANSPORT IN THE IRRIGATED SOILS OF GRAND VALLEY.

Maryland Univ., College Park. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5B.  
W78-07648

#### EVALUATING APPROPRIATE TECHNOLOGIES FOR SALINITY CONTROL IN GRAND VALLEY.

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering. R. G. Evans, W. R. Walker, S. W. Smith, and G. V. Skogerboe.  
In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 375-384, May 16-19, 1977. 3 fig, 2 tab, 3 ref.

Descriptors: \*Technology, Irrigation practices, Irrigation systems, Canal linings, Colorado, \*Colorado River Basin, \*Salinity, Irrigation, Economics, \*Grand Valley(Colo).

A summary of the results of applied research on salinity control of irrigation return flows in the Grand Valley of Colorado is presented for the period of 1969 to 1976. Salinity and economic impacts are described for the Grand Valley Salinity Control Demonstration Area which contains approximately 1600 hectares and involves most of the local irrigation entities in the valley. During the eight years of the demonstration project, 12.2 km of canals were lined, 26.54 km of laterals were lined, 16.4 km of drainage tile was installed, a wide variety of on-farm improvements were constructed, and an irrigation scheduling program was

implemented improvement most \$750,000 Colorado State W78-07649

#### DEVELOPMENT PRACTICES

GRAND VALLEY Colorado State Agricultural W. R. Walker In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 361-367, May 16-19 1977. 7 fig, 3 tab, 13 ref.

Descriptors: Colorado, \*Colorado River Basin, \*Salinity, \*Salts, Groundwater, \*Return flow, Seepage, Deep percolation, \*Grand Valley(Colo).

Cost-effective conveyance systems were western Colorado utilized to the relative farm improvement desalting. Application of where less 07606) (Skogerboe-Colorado State)  
W78-07650

#### THE EPA

Environment DC. K. Anderson In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 361-367, May 16-19 1977. 7 fig, 3 tab, 13 ref.

Descriptors: Colorado, \*Colorado River Basin, \*Salinity, \*Salts, Groundwater, \*Return flow, Seepage, Deep percolation, \*Grand Valley(Colo).

The Environment developed National (NPDES) sewers and return flows this general Federal 1977. This General 1978-07651

#### INTERFERENCE

QUALITY Colorado Economic For primary bibliographic entry see Field 3C.  
W78-07652

#### AN INFILTRATION

RIGATION MANAGEMENT Colorado Economic G. E. Rader In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 361-367, May 16-19 1977. 7 fig, 3 tab, 13 ref.

Descriptors: Water quality, Rights, W. R. Walker, G. V. Skogerboe, R. G. Evans, and S. W. Smith.

## Techniques Of Planning—Group 6A

implemented. The total value of the constructed improvements in the demonstration area was almost \$750,000. (See also W78-07606) (Skogerboe-Colorado State) W78-07649

#### DEVELOPMENT OF BEST MANAGEMENT PRACTICES FOR SALINITY CONTROL IN GRAND VALLEY.

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering. W. R. Walker, G. V. Skogerboe, and R. G. Evans. In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 385-393, May 16-19 1977. 5 fig. 7 ref.

Descriptors: Canal linings, Water quality, Water quality control, Desalination, \*Colorado River Basin, \*Salinity, Colorado, \*Grand Valley(Colo), \*Best management practices.

Cost-effectiveness functions for various on-farm, conveyance, and desalting salinity control alternatives were developed for the Grand Valley of western Colorado. These functions were then optimized to determine the best management practices on a valley-wide scale. The results indicate the relative importance of lateral linings and on-farm improvements over either canal lining or desalting. Generalized curves are presented for application of this analysis to other similar areas where less information is available. (See also W78-07606) (Skogerboe-Colorado State) W78-07650

#### THE EPA GENERAL PERMIT PROGRAM,

Environmental Protection Agency, Washington, DC. Anderson. In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 397-404, May 16-19 1977.

Descriptors: Agriculture, Water quality, \*Water quality control, Irrigation, Return flow, \*National Pollution Discharge Elimination System.

The Environmental Protection Agency (EPA) has developed a General Permit Program under the National Pollutant Discharge Elimination System (NPDES) which applies to both separate storm sewers and agricultural point sources (irrigation return flow conveyances). The proposed rules for this general permit program were printed in the Federal Register, Vol. 42, No. 24, February 4, 1977. This paper provides a guide as to how the General Permit Program is intended to function. (See also W78-07606) (Skogerboe-Colorado State) W78-07651

#### INTERFACE OF WATER QUANTITY AND QUALITY LAWS IN THE WEST,

Colorado State Univ., Fort Collins. Dept. of Economics. For primary bibliographic entry see Field 6E. W78-07652

#### AN INFLUENT CONTROL APPROACH TO IRRIGATION RETURN FLOW QUALITY MANAGEMENT,

Colorado State Univ., Fort Collins. Dept. of Economics. G. E. Radosevich, and G. V. Skogerboe. In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 423-434, May 16-19, 1977. 5 fig.

Descriptors: \*Water quality control, Agriculture, Water quality, \*Irrigation, \*Return flow, Water rights, Water management(Applied), \*Water policy.

The Influent Control Approach is based upon the assumption that improved water management plus improved agricultural practices will significantly contribute to improved water quality, and the conclusion that best management practices plus best agricultural practices will provide irrigation return flow quality control, which in turn will contribute significantly to the national goal of cleaner water through improved water quality. The Influent Control Approach consists of eight specific components: (1) designate areas for irrigation return flow quality management and designate the responsible area entity; (2) develop standards and criteria for beneficial use in designated areas; (3) introduce incentives to use water more efficiently; (4) include the element of water quality in new or transferred and changed water rights; (5) adopt and enforce a reporting and recording system for water rights; (6) recognize reasonable degradation from agricultural water use; and (7) adopt an Agricultural Practices Act; and (8) promote close cooperation or integration of state water agencies and related functions. (See also W78-07606) (Skogerboe-Colorado State) W78-07653

#### A PROCESS FOR IDENTIFYING, EVALUATING AND IMPLEMENTING SOLUTIONS FOR IRRIGATION RETURN FLOW PROBLEMS,

Colorado State Univ., Fort Collins. Dept. of Sociology. E. Vlachos, J. W. H. Barrett, P. Huszar, J. J. Layton, and G. E. Radosevich. In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 435-445, May 16-19, 1977. 1 fig. 1 tab.

Descriptors: \*Technology, Water quality, \*Water quality control, \*Return flow, Pollution, Economics, \*Institutions.

The purpose of the study has been to develop an effective process for implementing technical and institutional solutions to the problem of return flow pollution. The process developed is to: (1) define the problem in terms of its legal, physical, economic and social parameters, (2) identify potential solutions in relation to the parameters of the problem, (3) test the implementability of these potential solutions for diverse situations, and (4) specify those solutions or groups of solutions which are the most effective in reducing pollution and are implementable. This process is initially conceptualized and then the general results of its application to three study areas in the western United States are summarized. (See also W78-07606) (Skogerboe-Colorado State) W78-07654

MODEL STUDY OF COOL WATER DISCHARGE FROM PROPOSED LNG FACILITY, LOS ANGELES HARBOR, CALIFORNIA, Army Engineer Waterways Experiment Station, Vicksburg, MS. For primary bibliographic entry see Field 5B. W78-07669

#### DISPERSION OF PROPOSED EFFLUENT DISCHARGES AND SALTWATER INTRUSION IN COOPER RIVER: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, MS. For primary bibliographic entry see Field 5B. W78-07670

#### AN EVALUATION OF OIL AND GREASE CONTAMINATION ASSOCIATED WITH DREDGED MATERIAL CONTAINMENT AREAS.

Engineering-Science, Inc., Austin, TX. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A048 595. Price codes: A08 in paper copy, A01 in

microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. Technical Report D-77-25, November 1977. 147 p. 28 tab. 41 fig. 43 ref. append.

Descriptors: \*Oil pollution, \*Water pollution, Sampling, Evaluation, \*Dredged material, Waste disposal sites, \*Containment area, \*Greases.

The potential problem of contamination of receiving waters by oil and grease in return waters from dredged material containment areas is discussed. As a part of this study, field studies were conducted at six locations where dredging is practiced, and both water and sediment samples were collected at these sites. The samples were analyzed for various environmental factors with the intent of establishing whether or not the release of oil and grease from dredged sediments could be predicted on the basis of the environmental factors. The results of the field study strongly indicated that oil and grease are not released from sediment to a significant extent during the dredging process. It was found that relatively high oil levels in return waters were associated with high suspended solids concentrations, but that the various factors could not be related to the release of oil and grease from sediments. The report also presents the following: (a) An evaluation of oil and grease sampling and analytical techniques, (b) A literature review of potential treatment methods for the reduction of the oil and grease contents of containment area return waters. (WES) W78-07681

## 6. WATER RESOURCES PLANNING

### 6A. Techniques Of Planning

NONSTRUCTURAL FLOODPLAIN PLANNING, State Univ. of New York at Buffalo. Dept. of Industrial Engineering. For primary bibliographic entry see Field 6F. W78-07221

IMPLEMENTING COST-EFFECTIVE POLLUTION CONTROL BY MEANS OF EFFLUENT CHARGES: AN EXAMPLE APPLIED TO ELECTROPLATING DISCHARGES, Virginia Univ., Charlottesville. For primary bibliographic entry see Field 5G. W78-07481

CAPACITY PLANNING FOR REGIONAL WASTEWATER TREATMENT SYSTEMS, Worcester Polytechnic Inst., MA. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D. W78-07521

AN ENERGY MODEL OF PENNSYLVANIA, Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. T. L. Elchak. Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 112. Price codes: A07 in paper copy, A01 in microfiche. Master of Science thesis, The Pennsylvania State University, University Park, Dept. of Industrial Engineering, August, 1977. 131 p. 21 tab. 4 fig. 58 ref. 5 append. OWRT A-048-PA(1), 14-34-0001-7080.

Descriptors: \*Mathematical models, Energy conversion, \*Pennsylvania, \*Model studies, \*Energy models, Management, \*Energy consumption, \*Energy demand, \*Energy supply, Energy planner, Energy systems, Energy network, Linear flow modeling, Government services, British Thermal Unit.

## Field 6—WATER RESOURCES PLANNING

### Group 6A—Techniques Of Planning

The problem of meeting steadily increasing energy demands with dwindling energy resource supplies has become a continuing crisis in recent years for the states and the nation. On the state level, energy planners need a management tool which will describe the complex energy systems and the many possible energy interactions which exist within them. One such tool is presented. The mathematical model presented depicts the energy network in Pennsylvania for 1972 using a complex linear flow modeling technique. Using this technique, the interrelationships which exist among energy supply, energy conversion and energy consumption sectors can be examined. The time period chosen for study was one year. The homogeneous flow unit used was the British Thermal Unit. Data for the model were collected primarily from government services. Using this information and the model, various actual and hypothetical energy problems were evaluated, and the use of this model as an energy planning tool was demonstrated. (Sink-Penn State)  
W78-07685

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN THE NETHERLANDS.**  
Rijksdienst voor de IJsselmeerpolders, Lelystad (Netherlands).  
For primary bibliographic entry see Field 2A.  
W78-07692

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN THE U.S.A.,**  
American Society of Civil Engineers, New York.  
For primary bibliographic entry see Field 2A.  
W78-07700

### 6B. Evaluation Process

**CASE NOTE: WATER AND WATER COURSES - LIMITING THE RESERVATION DOCTRINE. MIMBRES VALLEY IRRIGATION CO. V. SALOPEK,** 564 P.2D 615(N.M.1977), CERT. GRANTED, 460 U.S.L.W. 3426(N.O.77-510), Wyoming Univ., Laramie. Coll. of Law.  
For primary bibliographic entry see Field 6E.  
W78-07211

**AN ATTEMPT TO QUANTIFY THE ESTHETICS OF WILD AND SCENIC RIVERS IN IDAHO,**  
Idaho Univ., Moscow. Dept. of Agricultural Economics.  
E. L. Michalson.

In: Proceedings: River Recreation Management and Research Symposium, January 24-27, 1977, Minneapolis, Minnesota. USDA Forest Service General Technical Report NC-28, North Central Forest Experiment Station, Forest Service, Department of Agriculture. St. Paul, Minn., p 320-328, 1977. 2 fig. 7 tab. OWRT C-3342(3718)(5).

Descriptors: \*Wild rivers, \*Aesthetics, \*Recreation demand, \*Estimating, \*Idaho, \*Schedules, \*Equations, \*Mathematical models, \*Systems analysis, \*Methodology, \*Economics.

Described is the procedure used to estimate demand for outdoor recreation on rivers and in the development of a Likert-Type Scale to distribute the net resource values estimated in the demand analysis according to perceptions that users indicated as being important to the wild and scenic river experience. Outdoor recreation demand models for three study areas on the Salmon River provide the basis for valuing outdoor recreation, and hence for evaluating aesthetics. Searched was a way to allocate value to the aesthetic portions of the whole outdoor recreation experience. To establish this relation, the methodology determines the amount of 'consumer surplus' involved

in the outdoor recreation experience and then estimates how much of it is related to aesthetics. Consumer surplus is defined as the difference between total utility and the market value of a good or service. It is concluded that this technique needs more study and research to determine its consistency and the stability of the distributions that have been developed. (Bell-Cornell)  
W78-07220

**INNOVATIVE MANAGEMENT CONCEPT FOR 208 PLANNING,**  
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07222

**AN ENGINEERING REPORT ON SELECTED RESERVOIR SITES IN THE BANDON AREA,**  
Oregon State Engineers Office, Salem. Watershed Planning Div.  
C. L. Wheeler.  
August 1974, 11 p, 20 fig.

Descriptors: \*Reservoirs, \*Feasibility studies, \*Oregon, \*Agriculture, \*Cranberries, \*Recreation, \*Sites, \*Water supply, \*Municipal water, \*Bandon area(OR).

Four possible reservoir sites are assessed for the Bandon (OR) area in terms of suitability for agricultural, municipal, and recreational uses. Bandon, a town of 1,940 people in 1973, is in an area of pasture and cranberry production. The Upper Bill Creek or Lower Bill Creek sites would provide an adequate water supply for Bandon, as well as storage to relieve seasonal agricultural shortages, but would not be well-suited for recreation. The Bear Creek Site, the largest considered, would meet all needs and would be the most economical in terms of costs per acre-ft of storage, but because of severe dislocation of homes, buildings, roads, and utilities, it is unlikely a reservoir would ever be constructed on the site. The Sevenmile Creek site would be adequate for recreation and for agricultural shortages, and possibly for municipal or domestic use, but seepage might cause excessive reservoir losses. An investigation of the substratum is recommended prior to any construction. All four sites would block anadromous fish runs, and provisions for passage of the fish would have to be made. The possibility that a large ground-water reservoir exists in the sand dunes north of Bandon should be investigated as a possible source of water for municipal and agricultural use. (Lynch-Wisconsin).  
W78-07280

**MANAGEMENT OF THE NORTHERN CHESAPEAKE BAY AMERICAN SHAD FISHERY,**  
Naval Academy, Annapolis, MD. Dept. of Oceanography.  
J. W. Foerster, and S. P. Reagan.  
Biological Conservation, Vol 12, No 3, November 1977, p 179-201, 12 fig, 1 tab, 23 ref.

Descriptors: \*Fish management, \*American shad, \*Chesapeake Bay, \*Commercial fishing, \*Shad, \*Fisheries, \*Maryland, \*Gill nets, \*Nets, \*Fishing gear, \*Alosa sapidissima, \*Susquehanna River, \*Spawning, \*Regulation, \*Commercial fish, \*Bays, \*Rivers, \*Estuaries, \*Recruitment, \*Overfishing.

An intensive analysis shows that the American Shad (*Alosa sapidissima*) fishery in northern Chesapeake Bay is declining in response to recruitment overfishing, which occurs when fishing mortality is high enough to reduce recruitment. American shad pass through the estuaries of the east coast of North America in the spring on their way to freshwater spawning grounds; at that time they enter an extensive fishery and are vulnerable to the harvesting pressure. Catch per unit effort (CPUE) has been declining over the last 30 years, while mobility to seek out the shad schools has increased due

to use of gill nets. Juveniles have declined with increased CPUE. Since 1890 the largest catch in Chesapeake Bay was 7.9 million kg in 1897, and the smallest was .99 million in 1936. The largest since 1943 was 2.7 million kg in 1945, and the smallest was 1.1 million in 1971. Reduction of spawning grounds and interference by dams have affected spawners, while the number of fishermen has increased. Limiting maximum effort in the fishery to 200,000 man-hours is recommended to approach a stable yield, and the management program should include: (1) adoption of rest days; (2) alternating of closed fishing areas; (3) enforcement of fishing regulations; (4) reduction in the number of meters of gill net used per fisherman; and (5) improvement of spawning grounds. (Lynch-Wisconsin)  
W78-07337

**MODERNIZATION AND IMPROVEMENT OF NEW YORK'S RIPARIAN LAW,**  
New York State Legislature, Albany.  
For primary bibliographic entry see Field 6E.  
W78-07410

**INSTREAM FLOW DECISION-MAKING IN THE PACIFIC NORTHWEST,**  
Washington State Univ., Pullman. Dept. of Political Science.  
For primary bibliographic entry see Field 6E.  
W78-07480

**HOW TO MEET WELL PROJECT GOALS: PART I,**  
For primary bibliographic entry see Field 4B.  
W78-07581

**AN ENERGY MODEL OF PENNSYLVANIA,**  
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.  
For primary bibliographic entry see Field 6A.  
W78-07685

**PROBLEM IDENTIFICATION AND RANKING, AN ASSESSMENT OF A RIVER BASIN PLANNING PROCESS,**  
Illinois Univ., at Urbana-Champaign. Dept. of Urban and Regional Planning.  
L. F. Blair, A. Harris, H. Felstehausen, W. T. Lamm, and T. A. Austin.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 100. Price codes: A07 in paper copy, A01 in microfiche. Regional Research Series, Water Resources Research Center, University of Minnesota, Number 2, January 1978, 121 p. OWRT B-057-1A(2), 14-31-0001-5140.

Descriptors: \*Planning, \*Problem identification, \*Mississippi River Basin, \*Evaluation, \*Comprehensive planning, \*Coordination, \*River basin management, \*River basin commission, \*Upper Mississippi River Basin Commission, \*Public participation, \*Economics, \*Investment.

The comprehensive, coordinated and joint planning process of the Upper Mississippi River Basin Commission is reviewed, and the process is analyzed according to parameters of efficiency and equity representative of four research disciplines: economics, political science, engineering and planning. Revisions to the existing planning process are recommended, as derived from the multi-disciplinary analysis.  
W78-07687

### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

**IRRIGATION WATER SUPPLY STUDY FOR RED PRAIRIE IRRIGATION DISTRICT, POLK AND YAMHILL COUNTIES, OREGON.**  
Oregon Water Resources Board, Salem.



## WATER RESOURCES PLANNING—Field 6

### Water Law and Institutions—Group 6E

For primary bibliographic entry see Field 3F.  
W78-07282

**ECONOMIC AND AGRONOMIC EFFECTS OF HIGH IRRIGATION LEVELS ON ALFALFA AND BARLEY.**  
Wyoming Univ., Laramie. Water Resources Research Inst.  
For primary bibliographic entry see Field 3F.  
W78-07397

**AN ECONOMIC ANALYSIS OF IRRIGATION RETURN FLOW RECYCLE SYSTEMS IN THE CENTRAL VALLEY OF CALIFORNIA.**  
California Univ., Davis. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 5G.  
W78-07625

**ECONOMICS OF CONTROLLING IRRIGATION RETURN FLOW IN THE MESILLA VALLEY, NEW MEXICO.**  
New Mexico State Univ., University Park.  
For primary bibliographic entry see Field 5G.  
W78-07635

### 6D. Water Demand

**FRESHWATER RESOURCES OF THE OREGON COASTAL ZONES.**  
Oregon Water Resources Board, Salem.  
For primary bibliographic entry see Field 2L.  
W78-07281

**IRRIGATION WATER SUPPLY STUDY FOR RED PRAIRIE IRRIGATION DISTRICT, POLK AND YAMHILL COUNTIES, OREGON.**  
Oregon Water Resources Board, Salem.  
For primary bibliographic entry see Field 3F.  
W78-07282

**ECONOMIC IMPACT OF WATER QUALITY ON RIVER BASIN MANAGEMENT.**  
California Univ., Davis. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W78-07396

**ENERGY AND WATER.**  
California Univ., Berkeley. Lawrence Berkeley Lab.; and California Univ., Berkeley. Div. of Energy and Environment.  
J. Harte, and M. El-Gasseir.  
Science, Vol. 199, No. 4329, p 623-634, February 10, 1978. 2 fig, 10 tab, 46 ref.

Descriptors: \*Energy, \*Resources development, \*Water requirements, \*Natural resources. Water utilization, Runoff, Coals, Oil shales, Natural gas, Oil, Consumptive use, Energy conversion, Water resources, Spatial distribution, Temporal distribution, Water demand, Freshwater, Cooling water, Fuels, \*Energy development.

The geographic and temporal variability of freshwater supply in the United States constrains the choice and level of use of future energy sources. Ecological criteria for acceptable freshwater consumption, together with hydrological data on stream flow, provide a framework for estimating these constraints. The water consumption requirements for a variety of energy options were presented, and comparative judgments were drawn. Attention was focused on problems resulting from synthetic, gaseous, and liquid fuel production. Scenarios describing possible future levels of coal and electricity use were analyzed. They point to the importance of water supply constraints in both the eastern and western United States. Water constraints on energy development

are sufficiently great to warrant far more attention. Two broad and urgent needs were identified. First is the need to develop adequate criteria for acceptable water consumption based on considerations of ecosystem balance, human well-being, nonuniform distribution of water, and the vicissitudes of its abundance under a capricious climate. Second is the need to set energy policy and water management on a course compatible with the criteria that are chosen. That course is certain to be characterized by a vital and enormous role for energy and water conservation. (Humphreys-ISWS)  
W78-07508

### 6E. Water Law and Institutions

**CASE NOTE: WATER AND WATER COURSES - LIMITING THE RESERVATION DOCTRINE. MIMBRES VALLEY IRRIGATION CO. V. SALOPEK.** 564 P.2D 615(N.M.1977).CERT.GRANTED,46U.S.L.W. 3426(NO.77-510).  
Wyoming Univ., Laramie. Coll. of Law.  
J. E. Masters.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 736. Price codes: A02 in paper copy, A01 in microfiche. Land and Water Law Review, Vol. XIII, No. 2, p 501-511, (1978). OWRT A-027-WYO(1), 14-34-0001-8054.

Descriptors: \*Water law, \*Water rights, \*Reservation doctrine, Watercourses, New Mexico, Recreation, \*Mimbres Valley decision(N Mex), Instream flows, Recreational purposes.

The reservation doctrine provides that when the federal government reserves public land for a particular purpose, it implicitly reserves enough unappropriated water to carry out that purpose. The doctrine has generated considerable uncertainty in the West with respect to water resources planning. This is largely due to the uncertainty as to the quantity of water the United States claims under the doctrine. Many western states have sought to quantify the federal claim of water, and Mimbres Valley arose out of such an attempt. The United States claimed that, when it reserved land under the Organic Act of 1897, it implicitly reserved water for instream flows and recreational purposes. Under the 1897 Act, national forests could be created for purposes of: (1) improving the forest, (2) protecting the watershed, and (3) providing a supply of timber. The Act does not mention instream flows and recreational purposes. The New Mexico Supreme Court concluded that when the forest in question was created by the reservation of land, its purposes were limited to the three express provisions of the 1897 Act. Since recreational purposes and instream flows were not envisioned when the land was reserved, no implied reservation of waters arose. Accordingly, the New Mexico Court denied the United States' claim. This case note analyzes the Mimbres Valley decision. The author concludes the case limits the application of the reservation doctrine to those instances where the government can clearly demonstrate that the federal purpose of the reservation requires a water right.  
W78-07211

**MODERNIZATION AND IMPROVEMENT OF NEW YORK'S RIPARIAN LAW.**  
New York State Legislature, Albany.  
W. H. Farnham.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-251 029. Price codes: A99 in paper copy, A01 in microfiche. December 1974. 591 p. OWRT B-003-NY(3).

Descriptors: \*New York, \*Riparian rights, \*Water resources, \*Legislation, \*Water law, Water resource development, Impoundments, Diversion, Constitutional law, Water rights, Lakes, Streams,

Water allocation(Policy). Judicial decisions. Prior appropriation. Common law. Public rights. Aesthetics. Land tenure. Protection. Protection. Public benefits. Social aspects. Preservation. Harmful use. Harmless use. Non-riparian rights.

Until 1966, the state of New York had no legislation which dealt specifically with riparian rights other than to recognize their existence. Since many court decisions were in conflict, the status of riparian law was uncertain. The author says that there are two ways to approach the problem of modernizing and improving the New York water law. One is to eliminate the uncertainties through a revision of the law compatible with the riparian doctrine. The other is to adopt all or part of the prior appropriation system of water law. The author examines the 1966 Environmental Conservation Law and the harmful Use Bill which was introduced in both 1967 and 1968. He concludes that the state has decided to stay with the riparian doctrine. Other improvements to the New York water law should include relaxation of restrictions on harmful non-riparian use of lake and stream water and a clarification of riparian rights in several areas. The final chapter deals in depth with private aesthetic interests in the lakes and streams of the state. (Capehart-Florida)  
W78-07410

**ADMINISTRATIVE PRACTICE AND PROCEDURE UNDER PERMIT SYSTEMS.**  
Clyde and Mecham, Salt Lake City, UT.  
E. W. Clyde.  
In: Water and Water Rights, Vol. 6, p 1-47, Allen Smith Co., Indianapolis, Indiana, 1972. 48 p.

Descriptors: \*Appropriation, \*Permits, \*Water allocation(Policy), \*Water rights, \*Priorities, Legal review, Administration, Administrative agencies, Easements, Preferences(Water rights), Beneficial use, Water law, Consumptive use, Groundwater, Surface waters, \*Procedural requirements.

Because of the legal uncertainties caused by the unauthorized appropriation of water, most western states have developed a statutory permit procedure designed to maintain order and efficiency in the appropriation of water. These permit procedures often vary depending on whether a surface water or ground water right is desired; consequently, it is critical for the appropriator to ascertain what permit requirements are applicable. Once this has been done, the appropriator will generally be required to file some type of application. Whether this application will be approved will depend on a weighing of the following factors: (1) availability of water; (2) availability of land and easements; (3) protection of prior rights; and (4) public interest considerations. Once the permit has been granted, a water right owner is usually free to change the use of water or to change the point of its diversion so long as the rights of others are not impaired. Such changes, however, may be effectuated only through the filing and approval of a change application on a prescribed form. If any water right applicant is dissatisfied with the decision of the administrative board or officer, he will be allowed an appeal to a court of general jurisdiction. The scope of this judicial review will be specified by statute. (Hoffman-Florida)  
W78-07411

**GENERAL ADJUDICATION PROCEEDINGS.**  
Clyde and Mecham, Salt Lake City, UT.  
E. W. Clyde.  
In: Water and Water Rights, Vol. 6, p 503-35, Allen Smith Co., Indianapolis, Indiana, 1972. 33 p.

Descriptors: \*Water policy, \*Allotments, \*Adjudication procedure, \*Prior appropriation, \*Water rights, Water law, Decision making, Judicial decisions, Legal review, Penalties(Legal), Water delivery, Regulation, Water utilization, State jurisdiction, Water contracts, Preferences(Water rights), Water consumption,

## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

Water users, Constitutional law, Legal aspects, \*Adjudication proceedings.

General adjudication proceedings provide a good means for making comprehensive determinations of water rights since they largely eliminate the problems of piecemeal determination of disputes and of locating and of serving notice on all claimants. Basically such a proceeding is in the nature of a declaratory judgement and fixes each appropriator's rights and priorities upon a river system. All users of water from the stream and all who claim rights to use such water are made parties to the action. The state engineer investigates and reports as to the relative rights of all users and his findings become part of the pleadings. Since a complicated general adjudication suit may take years to resolve, disputes arising between less than all the parties involved can be settled before the general adjudication to allow the water distribution to continue. While general adjudication proceedings have raised constitutional questions of notice and of due process, case law indicates that actual notice and an opportunity to be heard satisfy the constitutional requirement, and that personal service of process is not necessary. (Welch-Florida) W78-07412

#### PRACTICAL ASPECTS OF WATER LITIGATION.

Clyde and Mecham, Salt Lake City, UT. E. W. Clyde.

In: Water and Water Rights, Vol. 6, p 285-355, Allen Smith Co., Indianapolis, Indiana, 1972. 71 p.

Descriptors: \*Appropriation, \*Groundwater, \*Water rights, \*Priorities, Law enforcement, \*Legal aspects, Legislation, Judicial decisions, Governments, Penalties(Legal), Legal review, Water law, Equity, Jurisdiction, Regulation, Prior appropriation, Beneficial use, Preferences(Water rights), Institutional constraints, Damages, \*Western U.S.

Litigation involving water rights in the West often requires evidence spanning a long period of time because of the unique development of appropriation law determining priority upon proof of the time of first use of the water. This article examines practical aspects and problems which arise in such lawsuits. An action involving water rights is a local action and must be brought in the state where the water right is located, but even this can be difficult to determine. Numerous difficulties can arise even in areas such as pleadings and venue due to the special aspects of water rights litigation. This article places special emphasis upon the proof required in an alleged water rights suit and the difficulties encountered in sustaining that proof. Another area of water litigation covered extensively is that of groundwater and the trial preparations necessary in groundwater disputes. Appropriate measures and types of damages are also discussed, along with preventive remedies such as injunctions. (Welch-Florida) W78-07413

#### LANDMARK TEXAS DECISION AGREES BENEFIT IS NOT WORTH THE COST.

Dallas Water Utilities Dept., TX.

For primary bibliographic entry see Field 5G.

W78-07475

#### INSTREAM FLOW DECISION-MAKING IN THE PACIFIC NORTHWEST.

Washington State Univ., Pullman. Dept. of Political Science.

B. L. Lamb.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 035. Price codes: A13 in paper copy, A01 in microfiche. PhD Thesis, 1976. 271 p, 7 fig, 23 tab, ref. 2 append. OWRT A-077-WASH(1), 14-34-0001-6050.

Descriptors: \*Instream flow, Low flow, Minimum flow, \*Decision-making, Legal aspects, \*Pacific Northwest U.S., \*Institutional constraints, Administrative agencies, Water utilization, Competing uses.

An analysis is presented of the decision-making process in natural resources management, accomplished through investigation of the establishment of instream flows in the Pacific Northwest. Instream uses of water are those which use the water while it remains in the stream. These uses require water flow for fish and wildlife habitat, navigation, hydro-electric power production, recreation, aesthetics, and waste dilution. A wide variety of agencies of both the federal and state governments is involved in determining policy regarding the amount of water to be left in streams. Policy-making in the American political culture has traditionally reflected the interplay of a variety of interests, often conflicting situations. However, decision-making is more than conflict and bargaining among agencies. Four hypotheses are discussed. First, it is suggested that at the system level decision-making is characterized by bargaining. Second, it is suggested that at the group level decisions are made by muddling through, or incremental reliance on previous policy stands. Third, it is suggested that at the group level policy is made in part through organizational process. Agencies rely on a repertoire of procedures to collect and process information; they follow routine. Fourth, it is suggested that at the individual level agency representatives tend to align themselves with others in the same profession, thus mitigating conflicts between agencies. Data collected from a survey questionnaire, content analysis, and personal interviews are used in this analysis. (See also W76-11339 and W76-01797) W78-07480

#### TECHNICAL AND PHILOSOPHICAL ASPECTS OF OCEAN DISPOSAL.

Texas A and M Univ., College Station. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5E.

W78-07540

#### STATE AGENCIES AND OFFICIALS RESPONSIBLE FOR WATER WELL INDUSTRY CODES AND LICENSING.

Ground Water Age, Vol. 12, No. 9, p 19-20, p 44, May, 1978.

Descriptors: \*Water wells, \*Drilling, \*Licensing, \*State governments, Administrative agencies, Personnel, \*United States.

In conjunction with its 1978 survey on water well industry codes and licensing, Ground Water Age has published a list of state agencies and key personnel involved. At least one official is listed for each state and Puerto Rico. Complete addresses are furnished, and a short annotation defines the particular responsibility of the listed official(s) for each state. (Eberle-NWWA) W78-07573

#### WATER WELL INDUSTRY CODES AND LICENSING.

Ground Water Age, Vol. 12, No. 9, p 16-18, May, 1978. 1 tab.

Descriptors: \*Water wells, \*Drilling, \*Licensing, Legislation, State governments, Plastic pipe, Pitless adapters, \*United States.

Ground Water Age has recently completed its third annual survey of state agencies responsible for water well drilling codes and the licensing of water well drilling contractors and pump installers. The results are printed in tabular form, showing which states have water well codes, states which license drillers and pump installers, states requiring pitless adapters and those permitting use of

PVC pipe for water well construction. It is also reported that the majority of states have now implemented the Safe Drinking Water Act of 1974; 30 have done so thus far, with another 7 having incorporated implementation into a working timetable. The tabular results show a significant number of changes compared with a similar survey report of two years ago by Ground Water Age. (Eberle-NWWA) W78-07574

#### FORMULATING STATE GROUNDWATER POLICY IN PENNSYLVANIA.

Pennsylvania Dept. of Environmental Resources, Harrisburg.

For primary bibliographic entry see Field 5G.

W78-07576

#### GROUNDWATER LAW: THE RIPARIAN PROBLEM.

A. R. Pagan.

Journal of the American Water Works Association, Vol. 70, No. 3, p 153-155, March, 1978.

Descriptors: \*Reasonable use, \*Riparian rights, \*Competing uses, Groundwater, Judicial decisions, Legislation.

The legal doctrine of 'reasonable use' is a compromise between 'common enemy' rules (which favor unrestricted use and development of land, even to the detriment of a neighbor's ground water) and 'civil law' (which has essentially the opposite meaning and makes a developer susceptible to lawsuits and damages). Reasonableness is supposedly a factual question determined in each case, dependent on all parameters involved including property values, foreseeability of the result, and motives of the individuals involved. In the 19th century, many decisions were based on the so-called 'English rule' which was in turn based on a doctrine of absolute ownership, but was interpreted inconsistently in a notable series of cases. A much more definitive case decided in New Jersey in 1909 has been influential as precedent since that time (Meeker vs. East Orange). The judicial discussion is a well-considered exposition of the potential conflicts associated with ground water utilization, and serves as a clear support for reasonable use. (Eberle-NWWA) W78-07578

#### EUROPEAN WATER TREATMENT PRACTICES AND WHAT WE CAN LEARN FROM THEM.

Public Technology, Inc., Washington, DC.

For primary bibliographic entry see Field 5F.

W78-07604

#### THE ROLE OF EPA'S OFFICE OF RESEARCH AND DEVELOPMENT IN IRRIGATED CROP PRODUCTION RESEARCH.

Environmental Research Lab., Ada, OK. Office of Research and Development.

For primary bibliographic entry see Field 5G.

W78-07607

#### A VALLEYWIDE SOLUTION--THE INTERAGENCY DRAINAGE PROGRAM.

San Joaquin Valley Interagency Drainage Program, Fresno, CA.

For primary bibliographic entry see Field 4A.

W78-07639

#### THE 1973 AGREEMENT ON COLORADO RIVER SALINITY BETWEEN THE UNITED STATES AND MEXICO.

Colorado River Board of California, Los Angeles. M. B. Holburn.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado

State University, 333, May 16-

Descriptors: Control, \*Colorado States, International

The backlogs of the United States Colorado River early attempt and negotiatio a description implements actions are (Skogerboe) W78-07643

#### THE EPA GROUNDWATER

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#### INTERFACIAL QUALITY

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G. E. Rados

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State University, Fort Collins, Colorado, p 325-333, May 16-19 1977. 1 fig.

Descriptors: Water quality, \*Water quality control, \*Colorado River, \*Salinity, \*Mexico, United States, International waters.

The background of the conflict between the United States and Mexico over the salinity of the Colorado River water delivered to Mexico, the early attempts to resolve the conflict, the meetings and negotiations that led to the latest agreements, a description of the agreement, the legislation that implements that agreement, and necessary future actions are presented. (See also W78-07606) (Skogerboe-Colorado State) W78-07643

**THE EPA GENERAL PERMIT PROGRAM,** Environmental Protection Agency, Washington, DC. For primary bibliographic entry see Field 5G. W78-07651

**INTERFACE OF WATER QUANTITY AND QUALITY LAWS IN THE WEST,** Colorado State Univ., Fort Collins. Dept. of Economics. G. E. Radosevich.

In: Proceedings of National Conference on Irrigation Return Flow Quality Management, Colorado State University, Fort Collins, Colorado, p 405-422, May 16-19, 1977. 1 tab.

Descriptors: \*Water law, Water pollution, Agriculture, Return flow, Water quality, \*Water quality control, Water resources, \*Water rights, \*Irrigation.

Water Pollution from irrigated agriculture in the West has received major attention during the past five years, primarily as a result of federal and state endeavors to identify irrigation return flow quality problems and to develop a viable control strategy. The national goal of 'cleaner water' emerged as a result of the deterioration of water quality by degraded discharges from various sources. The key to irrigated agricultural return flow quality control is proper utilization and management of the resource itself, and an accepted tool in our society is the law. By legal classification, it is divided into laws for quantity control and laws for quality control. The laws on water quality control are recent, relatively uniform between states and with little exception, constrain improvement of return flows from irrigated agriculture. Unfortunately, in most others, they cannot really be said to facilitate this consequence either. The laws pertaining to water resources quantity control and management are complex, voluminous, inconsistent and lack uniformity among the 17 states of the West. (See also W78-07606) (Skogerboe-Colorado State) W78-07652

**AN INFLUENT CONTROL APPROACH TO IRRIGATION RETURN FLOW QUALITY MANAGEMENT,** Colorado State Univ., Fort Collins. Dept. of Economics. For primary bibliographic entry see Field 5G. W78-07653

**A PROCESS FOR IDENTIFYING, EVALUATING AND IMPLEMENTING SOLUTIONS FOR IRRIGATION RETURN FLOW PROBLEMS,** Colorado State Univ., Fort Collins. Dept. of Sociology. For primary bibliographic entry see Field 5G. W78-07654

## 6F. Nonstructural Alternatives

**NONSTRUCTURAL FLOODPLAIN PLANNING,** State Univ. of New York at Buffalo. Dept. of Industrial Engineering. W. F. Bialas, and D. P. Loucks. Water Resources Research, Vol. 14, No. 1, p 67-74, February 1978. 4 fig, 4 tab, 11 ref. OWRT C. 7183(6226)(2).

Descriptors: \*Flood control, \*Alternative planning, \*Optimization, \*Methodology, \*Flood plain zoning, Economic efficiency, Political feasibility, Benefit maximization, Land use, Constraints, Evaluation, Mathematical models, Equations, Systems analysis.

Recent years have been witness to increased annual flood damages in flood-prone regions despite increased flood protection expenditures. To reduce flood damage, more attention is being focused on nonstructural flood damage control measures, such as land use restrictions in regions of high flood risk, vis-a-vis structural measures such as dams and levees. Proposed are some mathematical optimization techniques to assist in the preliminary selection of economically efficient and politically feasible floodplain zoning plans. A problem is discussed wherein the model objective is the maximization of location rent derived from the land use allocations minus the annual expected flood damage and the annualized relocation costs. The methodology presented can be used as a relatively inexpensive means of identifying those policy alternatives worthy of more detailed simulation analyses. Its data requirements are compatible with those of simulation models that it is designed to accompany. (See also W77-10847; W76-12156 and W75-11060) (Bell-Cornell) W78-07221

**FLOOD DAMAGES ON THE IOWA RIVER,** Iowa Univ., Iowa City. Inst. of Hydraulic Research. For primary bibliographic entry see Field 4A. W78-07258

**EVALUATION OF THE COST-EFFECTIVENESS OF NONSTRUCTURAL POLLUTION CONTROLS: A MANUAL FOR WATER QUALITY MANAGEMENT PLANNING,** CONSAD Research Corp., Pittsburgh, PA. For primary bibliographic entry see Field 5G. W78-07336

## 6G. Ecologic Impact Of Water Development

**AN ATTEMPT TO QUANTIFY THE ESTHETICS OF WILD AND SCENIC RIVERS IN IDAHO,** Idaho Univ., Moscow. Dept. of Agricultural Economics. For primary bibliographic entry see Field 6B. W78-07220

**CITY OF NEWPORT NEWS AND FORT EUSTIS TIDAL MARSH INVENTORY,** Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 2L. W78-07224

**TIDAL MARSH BIBLIOGRAPHY, SELECTED KEY WORK INDEX (PARTIALLY ANNOTATED),** Delaware Univ., Newark. Coll. of Marine Studies. For primary bibliographic entry see Field 2L. W78-07226

**EFFECTS OF STREAM CHANNELIZATION ON TERRESTRIAL WILDLIFE AND THEIR HABITATS IN THE BUENA VISTA MARSH, WISCONSIN,** Wisconsin Cooperative Fishery Research Unit, Stevens Point. D. M. Prellwitz.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 231. Price codes: A04 in paper copy. A01 in microfiche. Report FWS/OBS-76/25. December, 1976. 66 p, 16 fig, 7 tab, 60 ref, 1 append.

Descriptors: \*Channeling, \*Drainage effects, \*Wildlife, \*Habitats, Wetlands, Marshes, Invertebrates, Succession, Plant populations, Dredging, Reptiles, Amphibians, Birds, Mammals, Waterfowl, \*Wisconsin, Animal populations, \*Buena Vista Marsh(Wisc), Riparian habitats.

Stream channelization affected wildlife in Buena Vista Marsh by draining wetlands, setting back plant succession, and decreasing habitat diversity along streambanks by removing or burying plants. Plant and animal species composition and abundance were studied in continuum of plant successional stages from grassland to mature woods on streambanks adjacent to recently dredged (6 years), old dredged (50 years), and natural streams. Sheet-water area and longevity and wildlife use of three sheet-water areas with various degrees of drainage were compared. Bird and mammal species diversity and bird abundance increased as streambank plant succession advanced, until a mature wooded stage was reached. Abundance of small mammals was related to the amount of ground cover and diversity of habitats along the streambanks. Sheet-water area and longevity were greatest on undrained wetlands and least near recently dredged channels. Waterfowl use, bird nesting, and reptile and amphibian abundance also were greatest on undrained areas. Invertebrates and various seeds made up 98.4 and 1.6 percent, respectively, of the diet of breeding blue-winged teal using sheet-water areas. (Stihler-Mass) W78-07228

**BACKGROUND ECOLOGY AND THE EFFECTS OF NUTRIENT ADDITIONS ON A CENTRAL MICHIGAN WETLAND,** Michigan Univ., Ann Arbor. School of Natural Resources. For primary bibliographic entry see Field 5C. W78-07279

**NORTHUMBERLAND COUNTY TIDAL MARSH INVENTORY,** Virginia Inst. of Marine Science, Gloucester Point. Wetlands Research Section. For primary bibliographic entry see Field 2L. W78-07311

**IMPACT OF A POWER PLANT ON THE GROUND-WATER SYSTEM OF A WETLAND,** Wisconsin Univ.-Madison. Dept. of Geology and Geophysics. C. B. Andrews, and M. P. Anderson. Ground Water, Vol. 16, No. 2, p 105-111, March-April 1978. 8 fig, 2 tab, 12 ref. EPA R803971020.

Descriptors: \*Powerplants, \*Wetlands, \*Wisconsin, Power system operation, Heat transfer, Groundwater resources, Cooling, Rivers, Cooling water, Heat flow, \*Wisconsin River, \*Groundwater system, Coal-fired plant, Cooling lake, Wetland biota, Lake management, Physical environment, Ash pit.

The impacts of a coal-fired powerplant on the groundwater system of a river floodplain wetland in central Wisconsin were quantified. The most important impacts are those related to the construction of a 200-ha cooling lake and a 28-ha ash pit. Several two-dimensional, vertically-oriented,



## Field 6—WATER RESOURCES PLANNING

### Group 6G—Ecologic Impact Of Water Development

steady-state models of the groundwater flow system were used to simulate groundwater flows before and after the filling of the cooling lake. The results of the simulation and supporting field evidence indicated that the creation of the cooling lake greatly alters the configuration of the flow system and increases the discharge of groundwater to the wetland west of the lake by a factor of six. Moreover, groundwater temperatures increase because of heat input from the cooling lake. Although the wetland biota respond to the altered physical environment, the high rate of leakage from the cooling lake is not undesirable from a lake management standpoint. Seepage to the groundwater system prevents a buildup of dissolved solids which would necessitate periodic flushing of the lake and release of saline water to the Wisconsin River. (Roberts-ISWS) W78-07377

#### FINAL ENVIRONMENTAL STATEMENT FOR WALKER DAM IMPOUNDMENT, AQUATIC PLANT CONTROL PROJECT, NEW KENT COUNTY, VIRGINIA.

Army Engineer District, Norfolk, VA.  
In: Appendix F, Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, Technical Report No. 13, Army Corps of Engineers, Aquatic Plant Control Program, September 1976. 42 p., 24 fig., 1 tab.

Descriptors: \*Environmental effects, \*Walker Dam Impoundment(VA), \*Chickahominy Reservoir(VA), \*Diquat, \*Endothall, \*Aquatic weed control, Chemcontrol, Herbicides, Virginia, Impoundments, Multiple-purpose reservoirs, Cost-benefit analysis, Eutrophication, Cyanophyta, Fishkill, Water pollution effects, Rehabilitation.

Environmental effects of chemcontrol of Egeria densa in Walker Dam Impoundment (Chickahominy Reservoir) near Richmond, Virginia, through single application of a 50-50 mixture of diquat dibromide and potassium endothall, are evaluated. The entire 100-acre impoundment is to be sprayed with the chemicals from an airboat at 1.5 gal/surface acre. Egeria now infests a large portion of the reservoir; its control would increase recreation opportunities, ensure adequate water velocity for intake systems, and increase fish production. Adverse effects projected: (1) minor fish kills due to oxygen depletion induced by plant decomposition; (2) possible infestation of blue-green algae when nutrients are no longer absorbed by rooted plants; (3) reservoir water becoming undrinkable for about two weeks; and (4) potential damage to an adjacent tree farm. Alternatives to the proposed course of action, all considered either less effective or less practical, are: (1) no improvement; (2) alteration of lake habitat through water level reduction; (3) mechanical control; and (4) removal of nutrient inputs. The reservoir, which supplies part of the city water of Newport News and Williamsburg, is also noted for its fishery. Some 200 surface acres have been filled the last 25 years due in part to the plant infestation, however, and its utility both for water supply and for fishing is in jeopardy. (See also W78-07399) (Lynch-Wisconsin) W78-07403

#### MARINE WASTE DISPOSAL IN THE NEW YORK BIGHT—PUBLIC POLICY, ENVIRONMENTAL IMPACTS, AND ALTERNATIVE FUTURES.

National Association of Regional Councils, Washington, DC.  
For primary bibliographic entry see Field 5F. W78-07529

#### ENVIRONMENTAL CONSIDERATIONS RELATING TO OPERATION AND MAINTENANCE OF THE TEXAS GULF INTRACOASTAL WATERWAY.

Texas A and M Univ., College Station. Ocean Engineering Program.

For primary bibliographic entry see Field 2L. W78-07538

#### ENVIRONMENTAL MANAGEMENT OF A SHIP CHANNEL-HARBOR COMPLEX.

Texas A and M Univ., College Station. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5B. W78-07539

#### ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. ANNUAL REPORTS SUMMARY FOR THE YEAR ENDING MARCH 1977.

Science Applications, Inc., Boulder, CO.  
Prepared for NOAA Environmental Laboratories, Boulder, CO., August 1977. 747 p.

Descriptors: \*Alaska, \*Resources development, Water pollution sources, Environmental effects, Baseline studies, \*Outer Continental shelf, Petroleum development.

Reports containing baseline studies are compiled in this annual reports summary. The summaries grouped by geographic units are intended to serve as markers or as a frame of reference from which to assess the potential environmental impact that might result from resources development, petroleum in particular, on the outer continental shelf of Alaska. This compilation contains summaries of studies in the following areas: Northeast Gulf of Alaska, Lower Cook Inlet, Kodiak Shelf, Aleutian Shelf, Bristol Bay, St. George Basin, Norton Sound, Chukchi Sea, Beaufort Sea, and Biological effects studies. (NOAA) W78-07557

#### ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME I. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER APRIL - JUNE 1977.

National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.  
October 1977. 979 p.

Descriptors: \*Alaska, \*Aquatic life, \*Water pollution effects, \*Baseline studies, Resources development, Oil pollution, Aquatic microbiology, Environmental effects, \*Outer Continental Shelf, Petroleum development.

Reports containing baseline studies are compiled in this quarterly report. They are intended to serve as markers or as points of departure from which to assess the potential environmental impact that might result from petroleum resources development and transport on the outer continental shelf of Alaska. The reports are grouped in the following categories: Receptors (Biota)—marine mammals, marine birds, marine fish, and microbiology; Contaminant Baselines; and Effects. (NOAA) W78-07558

#### ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME II. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER APRIL - JUNE 1977.

National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.  
October 1977. 942 p.

Descriptors: \*Alaska, \*Water pollution sources, \*Baseline studies, Hazards, Data processing, Transport, \*Outer Continental Shelf, Petroleum development.

Reports containing baseline studies are compiled in this quarterly report. They are intended to serve as markers or as points of departure from which to assess the potential environmental impact that might result from petroleum resources develop-

ment and transport on the outer continental shelf of Alaska. The reports are grouped in the following categories: Transport, hazards and data management. (NOAA) W78-07559

#### ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME I. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER JULY - SEPTEMBER 1977.

National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.  
December 1977. 606 p.

Descriptors: \*Alaska, \*Water pollution sources, \*Water pollution effects, \*Baseline studies, Environmental effects, Resources development, Oil pollution, \*Outer Continental Shelf, Petroleum development.

Reports containing baseline studies are compiled in this quarterly report. They are intended to serve as markers or as points of departure from which to assess the potential environmental impact that might result from petroleum resources development and transport on the outer continental shelf of Alaska. The reports are grouped in the following categories: aquatic life, effects, and contaminant baselines. (NOAA) W78-07560

#### ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME II. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER JULY - SEPTEMBER 1977.

National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.  
December 1977. 774 p.

Descriptors: \*Alaska, \*Water pollution sources, \*Water pollution effects, \*Baseline studies, Environmental effects, Oil pollution, Fish, Microbiology, \*Outer continental shelf, Petroleum development.

Reports containing baseline studies are compiled in this quarterly report. They are intended to serve as markers or as points of departure from which to assess the potential environmental impact that might result from petroleum resources development and transport on the outer continental shelf of Alaska. The reports are grouped in the following categories: aquatic life - fish, and microbiology. (NOAA) W78-07561

#### ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME III. PRINCIPAL INVESTIGATORS' REPORTS FOR THE QUARTER JULY - SEPTEMBER 1977.

National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.  
December 1977. 856 p.

Descriptors: \*Alaska, \*Water pollution sources, \*Water pollution effects, \*Baseline studies, Environmental effects, Resources development, Oil pollution, Hazards, Data processing, \*Outer Continental Shelf, Pollutant transport, Petroleum development.

Reports containing baseline studies are compiled in this quarterly report. They are intended to serve as markers or as points of departure from which to assess the potential environmental impact that might result from petroleum resources development and transport on the outer continental shelf of Alaska. The reports are grouped in the following categories: transport, hazards, and data management. (NOAA) W78-07562

ASSESSMENT OF STREAM FLOWS AND WILDLIFE TAINS AT (EXECUTIVE) Enviro Control W. Nelson, G. Publication N p. WELUT N

Descriptors: \*Dams, M resources, \*Pacific Northwest, Oregon, Colorado, Mining, Institutions

The report contains recommendations below dams methodology for 96 dams and Pacific Northwest Service) W78-07563

ASSESSMENT OF STREAM FLOWS AND WILDLIFE TAINS AT (EXECUTIVE) Jones and S. CA. C. Hazel.

Available from Service Price codes: Publication 1 19 p. WELUT

Descriptors: \*Dams, M resources, \*California,

The report contains recommendations below dams methodology for 46 dams Wildlife Ser W78-07564

ASSESSMENT OF STREAM FLOWS AND WILDLIFE TAINS AT (EXECUTIVE) Jones and S. CA. C. Hazel.

Available from Service Price codes: Publication 48 p. WELUT

Descriptors: \*Dams, resources, \*California,

The report contains recommendations below dams methodology for 46 dams Wildlife Ser W78-07565

ASSESSMENT OF STREAM FLOWS AND WILDLIFE TAINS AT (EXECUTIVE) Jones and S. CA. C. Hazel, S.

## RESOURCES DATA—Field 7

### Data Acquisition—Group 7B

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (EXECUTIVE SUMMARY).

Enviro Control, Inc., Rockville, MD.  
W. Nelson, G. Horack, M. Lewis, and J. Colt.  
Publication No. FWS/OBS-76/28, August 1976, 14 p. WELUT No. 049-75, FWS 14-16-0008-956.

Descriptors: \*Minimum flow, \*Instream flow, \*Dams, Management, \*Fisheries, Water resources, Water development, Hydrology, \*Pacific Northwest U.S., \*Rocky Mountain region, Oregon, Washington, Idaho, Arizona, Colorado, Montana, New Mexico, Utah, Wyoming, Institutions.

The report contains the findings, conclusions and recommendations regarding changed flow regimes below dams, the impact on fisheries and methodologies used to assess flow requirements for 96 dams and diversions in the Rocky Mountain and Pacific Northwest regions. (Fish and Wildlife Service)  
W78-07563

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART B: CALIFORNIA (EXECUTIVE SUMMARY).

Jones and Stokes Associates, Inc., Sacramento, CA.  
C. Hazel.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 352, Price codes: A02 in paper copy, A01 in microfiche. Publication No. FWS/OBS-76/32, December 1976, 19 p. WELUT No. 049-75, FWS 14-16-0008-955.

Descriptors: \*Minimum flow, \*Instream flow, \*Dams, Management, \*Fisheries, Water resources, Water development, Hydrology, \*California, Institutions.

The report contains the funding conclusions and recommendations regarding changed flow regimes below dams, the impact on fisheries, and methodologies used to assess flow requirements for 46 dams and diversions in California. (Fish and Wildlife Service)  
W78-07564

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART B: CALIFORNIA (FINAL REPORT).

Jones and Stokes Associates, Inc., Sacramento, CA.  
C. Hazel.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 245, Price codes: A04 in paper copy, A01 in microfiche. Publication No. FWS/OBS-76/33, December 1976, 48 p. WELUT No. 049-75, FWS 14-16-0008-955.

Descriptors: \*Minimum flow, \*Instream flow, \*Dams, Management, \*Fisheries, Water resources, Water development, Hydrology, \*California, Institutions.

The report contains analysis, funding, conclusions and recommendations regarding changed flow regimes below dams, the impact of fisheries, and methodologies used to assess flow requirements for 46 dams and diversions in California. (Fish and Wildlife Service)  
W78-07565

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART B: CALIFORNIA (CASE STUDIES).

Jones and Stokes Associates, Inc., Sacramento, CA.  
C. Hazel, S. Herrera, H. Rectenwald, and J. Ives.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 246, Price codes: A99 in paper copy, A01 in microfiche. Publication No. FWS/OBS-76/34, December 1976, 606 p. WELUT No. 049-75, FWS 14-16-0008-955.

Descriptors: \*Minimum flow, \*Instream flow, \*Dams, Management, \*Fisheries, Water resources, Water development, Hydrology, \*California, Institutions.

The report contains individual analysis of changes flow regimes below dams, the impact on fisheries and methodologies used to assess flow requirements for 46 dams and diversions in California. (Fish and Wildlife Service)  
W78-07566

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (FINAL REPORT).

Enviro Control, Inc., Rockville, MD.  
W. Nelson, G. Horack, M. Lewis, and J. Colt.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 470, Price codes: A07 in paper copy, A01 in microfiche. Publication No. FWS/OBS-76/29, December 1976, 120 p. WELUT No. 049-75, FWS 14-16-0008-956.

Descriptors: \*Minimum flow, \*Instream flow, \*Dams, Management, \*Fisheries, Water resources, Water development, Hydrology, \*Pacific Northwest U.S., \*Rocky Mountain region, Oregon, Washington, Idaho, Arizona, Colorado, Montana, New Mexico, Utah, Wyoming, Institutions.

The report contains analysis, findings, conclusions and recommendations regarding changed flow regimes below dams, the impact on fisheries and methodologies used to assess flow requirements for 96 dams and diversions in the Rocky Mountain and Pacific Northwest Regions. (Fish and Wildlife Service)  
W78-07567

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (ROCKY MOUNTAIN REGION CASE STUDIES).

Enviro Control, Inc., Rockville, MD.  
W. Nelson, G. Horak, A. Hale, Z. Parkhurst, and M. Lewis.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 471, Price codes: A16 in paper copy, A01 in microfiche. Publication No. FWS/OBS-76/30, December 1976, 371 p. WELUT No. 049-75, FWS 14-16-0008-956.

Descriptors: \*Minimum flow, \*Instream flow, \*Dams, Management, \*Fisheries, Water resources, Water development, Hydrology, \*Rocky Mountain region, Arizona, Colorado, Montana, New Mexico, Utah, Wyoming, Institutions.

The report contains individual analysis of changed flow regimes below dams, the impact on fisheries and methodologies used to assess flow requirements for 49 dams and diversions in the Rocky Mountain Region. (Fish and Wildlife Service)  
W78-07568

#### ASSESSMENT OF EFFECTS OF ALTERED STREAM FLOW CHARACTERISTICS ON FISH AND WILDLIFE, PART A: ROCKY MOUNTAINS AND PACIFIC NORTHWEST (PACIFIC NORTHWEST REGION CASE STUDIES).

Enviro Control, Inc., Rockville, MD.  
W. Nelson, G. Hovak, A. Hale, Z. Parkhurst, and M. Lewis.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 472, Price codes: A18 in paper copy, A01 in microfiche. Publication No. FWS/OBS-76/31, December 1976, 398 p.

Descriptors: \*Minimum flow, \*Streamflow, \*Dams, Management, \*Post-audit studies, \*Fisheries, Water resources, Water development, Hydrology, \*Pacific Northwest, Oregon, Washington, Idaho, Institutions.

The report contains individual analysis of changed flow regimes below dams, the impact on fisheries and methodologies used to assess flow requirements for 47 dams and diversions in the Pacific Northwest Region. (Fish and Wildlife Service)  
W78-07569

## 7. RESOURCES DATA

### 7B. Data Acquisition

**CONTAMINATING SPILL DETECTION ARRANGEMENT.**  
For primary bibliographic entry see Field 5A.  
W78-07241

**IMPROVED UNDER-WATER SAMPLER FOR LIMNOLOGICAL WORK.**  
Udaipur Univ. (India). Dept. of Zoology.  
V. S. Durve, and L. L. Sharma.  
Research and Industry, Vol. 21, No. 2, p 93-94, June 1976. 1 fig, 1 ref.

Descriptors: \*Sampling, \*Samplers, \*Research equipment, \*Water temperature, \*Dissolved gases, \*On-site tests, Monitoring, On-site data collections, Measurement, Gases, Equipment.

An improved device capable of collecting water samples for dissolved gases estimation as well as water temperature measurement is described. It costs (Indian currency) only Rs 83, compared to Rs 500-1000 for conventional devices. A previous version could not be used for measuring dissolved gases because of bubbling, a limitation corrected in the improved sampler. The device consists of a wide-mouthed vacuum flask mounted in a weighted steel frame, with a cork stopper held in place by a screw-cap. Three holes in the cork accommodate a large 50C thermometer and two 0.5 cm-diameter brass pipes. To one pipe (the water inlet), which protrudes only 1.5 cm, a polythene tube is attached which reaches the bottom of the flask. The second tube is the air exhaust, protruding 6 cm above the cork. A tripping mechanism allows the bottle to be opened and closed at the desired depth. It consists of a square rod (moving in a square tube to prevent rotation), connected to two steel closing plates with soft rubber seals to ensure perfect closure. A string to the surface opens the mechanism, and a spring closes it. Water entering the inlet pipe flows directly to the bottom of the sampler through the polythene tube, replacing the inside air slowly so there is no bubbling. The sampler, which fills in 30 sec., has been successfully used to depths of 50 ft. Use of a plastic bottle inside the flask permits direct collection of oxygen samples. (Lynch-Wisconsin)  
W78-07276

**LAND USE AND POLLUTION PATTERNS ON THE GREAT LAKES.**  
Cold Regions Research and Engineering Lab., Hanover, NH.  
For primary bibliographic entry see Field 5B.  
W78-07288

**YORK COUNTY AND TOWN OF POQUOSON TIDAL MARSH INVENTORY.**  
Virginia Inst. of Marine Science, Gloucester Point. Wetlands Research Section.

## Field 7—RESOURCES DATA

### Group 7B—Data Acquisition

For primary bibliographic entry see Field 2L.  
W78-07310

**NORTHUMBERLAND COUNTY TIDAL MARSH INVENTORY.**  
Virginia Inst. of Marine Science, Gloucester Point. Wetlands Research Section.  
For primary bibliographic entry see Field 2L.  
W78-07311

**THE SOUTH DAKOTA COOPERATIVE LAND USE EFFORT: A STATE LEVEL REMOTE SENSING DEMONSTRATION PROJECT.**  
South Dakota State Planning Bureau, Pierre; and Geological Survey, Sioux Falls, SD. EROS Data Center.  
For primary bibliographic entry see Field 4A.  
W78-07315

**THE NATIONAL LAND USE DATA PROGRAM OF THE U.S. GEOLOGICAL SURVEY.**  
Geological Survey, Reston, VA. Land Information and Analysis Office.  
For primary bibliographic entry see Field 4A.  
W78-07316

**LAND USE AND ENVIRONMENTAL ASSESSMENT IN THE CENTRAL ATLANTIC REGION.**  
Geological Survey, Reston, VA. Land Information and Analysis Office.  
For primary bibliographic entry see Field 4A.  
W78-07317

**VISUAL OBSERVATIONS OF FLOATING ICE FROM SKYLAB.**  
Geological Survey, Tacoma, WA. Water Resources Div.; Department of the Environment, Ottawa (Ontario); and Cold Regions Research and Engineering Lab., Hanover, NH.  
For primary bibliographic entry see Field 2C.  
W78-07346

**SALINITY: ITS DEFINITION AND CALCULATION.**  
Department of the Environment, Victoria British (Columbia). Frozen Sea Research Group.  
For primary bibliographic entry see Field 2K.  
W78-07367

**DIELECTRIC CONSTANT AND ELECTROCONDUCTANCE OF SOME DRY FROST-PRONE SOILS.**  
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 2C.  
W78-07369

**NORTH AMERICAN GLACIAL HISTORY EXTENDED TO 75,000 YEARS AGO.**  
Washington Univ., Seattle. Dept. of Zoology; and Washington Univ., Seattle. Dept. of Geological Sciences.  
For primary bibliographic entry see Field 2C.  
W78-07372

**DYE INFUSION TECHNIQUE ASSESSES STREAM POLLUTION IN OHIO.**  
Youngstown State Univ., OH. Dept. of Chemical Engineering.  
For primary bibliographic entry see Field 5B.  
W78-07373

**APPENDIX E TO CORRELATION OF DUAL-CHANNEL AIRBORNE IR DATA WITH SOIL MOISTURE MEASUREMENTS.**  
Development and Resources Transportation Co., Silver Spring, MD.  
For primary bibliographic entry see Field 2G.  
W78-07383

**VORTEX-SHEDDING FLOWMETERS.**  
Water Services, Vol. 82, No. 986, p 241-242. April, 1978. 3 fig, 1 tab.

Descriptors: \*Flowmeters, \*Instrumentation, \*Measurement, \*Digital computers, \*Analog computers, Flow rates, Flow measurement, Flow profiles, Liquid wastes, Gases, Wastes.

Neptune International Corporation has developed a vortex-shedding flowmeter, the Vort-X-Cel, which supplies a digital flow rate output. The system contains a sensor whose pulses are converted into flow rate measurements by two signal processing modules. Power is supplied by modules with input ranges of 24-35 Vdc, 111 Vac, or 220 Vac. The flow rate read-out can be provided by an optional scaling circuit module in engineering measurements, such as gal, barrels, or cu ft; analog output is also an available option. For accurate measurement, the flow transmitter should be installed in an unobstructed pipe without protruding gaskets or weld beads upstream. Pressure taps may be installed at a distance, four pipe diameters upstream from the transmitter; temperature taps should be no more than two pipe diameters downstream. The Vort-X-Cel flowmeter is applicable to liquid and gas streams. (Lisk-FIRL)  
W78-07459

**MULTIPLE TENSIMETER FLUSHING SYSTEM.**  
Agricultural Research Service, Riverside, CA. Salinity Lab.  
For primary bibliographic entry see Field 2G.  
W78-07499

**A SIMPLE LABORATORY APPARATUS TO MEASURE RELATIVE ERODIBILITY OF SOILS.**  
Allahabad Univ. (India).  
For primary bibliographic entry see Field 2J.  
W78-07504

**FLOODPLAIN DELINEATION USING LANDSAT-1 DATA.**  
Pennsylvania State Univ., University Park. Space Science and Engineering Lab.  
For primary bibliographic entry see Field 4A.  
W78-07510

**SAMPLING OF WATER AND WASTEWATER.**  
EG and G Washington Analytical Services Center, Inc., Rockville, MD.  
For primary bibliographic entry see Field 5A.  
W78-07517

**A CORING AND SQUEEZING TECHNIQUE FOR THE DETAILED STUDY OF SUBSURFACE WATER CHEMISTRY.**  
Queen's Univ., Kingston (Ontario). Dept. of Geological Sciences.  
For primary bibliographic entry see Field 2K.  
W78-07575

**POSITIONING TECHNIQUES AND EQUIPMENT FOR U. S. ARMY CORPS OF ENGINEERS HYDROGRAPHIC SURVEYS.**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
E. D. Hart, and G. C. Downing.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 062. Price codes: A08 in paper copy, A01 in microfiche. Technical Report H-77-10, May 1977. 166 p, 105 fig, 7 ref, 4 append.

Descriptors: \*Surveying instruments, Equipment, Instrumentation, \*Hydrographic surveys.

Techniques and equipment are described that can be used by U. S. Army Corps of Engineers personnel

in the 38 Districts to perform hydrographic surveys. These techniques should improve each District's operating efficiency by reducing the time lag between data collection and final report or completed chart. The report uses simple explanations and nonmathematical descriptions of the subjects covered and should be readable by all levels of survey branch personnel. Names and addresses of manufacturers' representatives are included in Appendix A to aid the reader in obtaining up-to-date technical information. A list of key Corps personnel engaged in hydrographic surveying is included in Appendix D to facilitate information interchange. (WES)  
W78-07676

**INVESTIGATION OF REMOTE WATER-QUALITY MONITORING SYSTEMS FOR USE WITH GOES OR ERTS WATER DATA TRANSMITTER.**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
For primary bibliographic entry see Field 5A.  
W78-07678

### 7C. Evaluation, Processing and Publication

**WATER QUALITY MODEL FOR THE UPPER NORTH PLATTE RIVER.**  
Wyoming Univ., Laramie. Water Resources Research Inst.  
For primary bibliographic entry see Field 5B.  
W78-07206

**CITY OF NEWPORT NEWS AND FORT EUSTIS TIDAL MARSH INVENTORY.**  
Virginia Inst. of Marine Science, Gloucester Point.  
For primary bibliographic entry see Field 2L.  
W78-07224

**COPEPOD4: A DISCRETE TIME-DELAY MODEL OF COPEPOD POPULATION DYNAMICS.**  
Oak Ridge National Lab., TN., Environmental Sciences Div.  
For primary bibliographic entry see Field 5B.  
W78-07289

**INDEX OF SURFACE-WATER STATIONS IN TEXAS, OCTOBER 1977.**  
Geological Survey, Austin, TX. Water Resources Div.  
Texas District Report, 1977. 19 p, 1 plate, 2 tab.

Descriptors: \*Indexing, \*Surface waters, \*Data collections, \*Texas, Sites, Gaging stations, Water quality, Sediment transport, Streamflow, Reservoirs, Tides.

This index of investigations of surface-water resources in Texas shows the station number and name, type of data collected, and the office principally responsible for the data collection. As of October 1, 1977, 437 stream-gaging, 81 reservoir-content, 13 stage, 66 flood-hydrograph partial-record, 12 flood-profile partial-record, 66 low-flow partial-record, 13 crest-stage partial-record, 67 tide-level, 122 daily chemical quality, 29 continuous-recording water-quality, 198 periodic chemical-quality, 163 periodic organic-quality, 104 pesticides, 6 sediment, 50 periodic sediment, 95 periodic biological, and 66 reservoir-inventory stations were in operation. (Woodard-USGS)  
W78-07312

**WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1976.**  
Geological Survey, St. Paul, MN. Water Resources Div.

Available from  
tion Service.  
Price codes:  
Water-Data  
fig.

Descriptors:  
\*Surface wa  
Gaging stati  
ment transp  
ture, Chemi  
wells, Water

Water resou  
Minnesota c  
and water q  
water quali  
levels and w  
report conta  
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## Evaluation, Processing and Publication—Group 7C

Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 319. Price codes: A99 in paper copy, A01 in microfiche. Water-Data Report MN-76-1, July 1977. 896 p, 5 fig.

Descriptors: \*Minnesota, \*Hydrologic data, \*Surface waters, \*Groundwater, \*Water quality, \*Gaging stations, \*Streamflow, \*Flow rates, \*Sediment transport, \*Water analysis, \*Water temperature, \*Chemical analysis, \*Lakes, \*Reservoirs, \*Water wells, \*Data collections, \*Sites.

Water resources data for the 1976 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 131 gaging stations; stage only records for 1 gaging station; stage and contents for 9 lakes and reservoirs; water quality for 65 gaging stations, 14 partial-record flow stations, 26 lakes, and 42 wells; and water levels for 30 observation wells. Also included are 149 crest-stage partial-record stations and 340 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (Woodard-USGS) W78-07313

#### WATER RESOURCES DATA FOR ARKANSAS, WATER YEAR 1976.

Geological Survey, Little Rock, AZ. Water Resources Div.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 328. Price codes: A99 in paper copy, A01 in microfiche. Water-Data Report AR-76-1, September 1977. 654, 5 fig, 3 tab.

Descriptors: \*Arkansas, \*Hydrologic data, \*Surface waters, \*Groundwater, \*Water quality, \*Gaging stations, \*Streamflow, \*Flow rates, \*Sediment transport, \*Water analysis, \*Water temperature, \*Chemical analysis, \*Lakes, \*Reservoirs, \*Water wells, \*Data collections, \*Sites.

Water resources data for the 1976 water year for Arkansas consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels of wells. This report contains discharge records for 70 gaging stations; stage only records for 1 gaging station; stage and contents for 16 lakes and reservoirs; water quality for 132 stations, 33 partial-record flow stations, and 8 lakes; and water levels for 76 observation wells. Also included are 119 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Arkansas. (Woodard-USGS) W78-07314

#### THE NATIONAL LAND USE DATA PROGRAM OF THE U.S. GEOLOGICAL SURVEY.

Geological Survey, Reston, VA. Land Information and Analysis Office.

For primary bibliographic entry see Field 4A.

W78-07316

#### WATER RESOURCES OF THE WEISER RIVER BASIN, WEST-CENTRAL IDAHO,

Geological Survey, Boise, ID. Water Resources Div.

For primary bibliographic entry see Field 4A.

W78-07342

#### DOWNSTREAM-UPSTREAM RESERVOIR ROUTING,

Geological Survey, Bay Saint Louis, MS. Water Resources Div.

For primary bibliographic entry see Field 4A.

W78-07344

#### REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS--OKLAHOMA, 1977 WATER YEAR,

Geological Survey, Little Rock, AR. Water Resources Div.

For primary bibliographic entry see Field 4A.

W78-07345

#### AVAILABILITY AND QUALITY OF GROUND WATER IN THE DRAIN-YONCALLA AREA, DOUGLAS COUNTY, OREGON,

Geological Survey, Portland, OR. Water Resources Div.

J. H. Robison, and C. A. Collins.

Water-Resources Investigations 76-105 (open-file report), 1977. 2 sheets, 12 ref.

Descriptors: \*Groundwater resources, \*Maps, \*Water wells, \*Hydrologic data, \*Water quality, \*Oregon, \*Pumping, \*Water yield, \*Water levels, \*Water analysis, \*Chemical analysis, \*Water supply, \*Water users, \*Domestic water, \*Douglas County(Oreg), \*Yoncalla area(Oreg).

Maps of the Yoncalla area, Douglas County, Oregon, show areal geology, locations and chemical diagrams of wells with water analyses; and diagrams showing the depth to water, pumping level, total depth, and yields of selected wells. Reported yields of wells range from less than 1 to as much as 75 gallons per minute; the average is less than 15. A table listing chemical analyses of water indicates that, although most ground water is of adequate quality for domestic use, some wells yield water with dissolved constituents in excess of limits recommended by the Environmental Protection Agency for drinking water. (Woodard-USGS) W78-07347

#### UNSTEADY-STATE WATER-QUALITY MODEL,

Geological Survey, Lakewood, CO. Water Resources Div.; and Geological Survey, Bay Saint Louis, MS. Water Resources Div.

For primary bibliographic entry see Field 5B.

W78-07348

#### RAINFALL AND RUNOFF DATA FROM SMALL BASINS IN WYOMING,

Geological Survey, Cheyenne, WY. Water Resources Div.

J. G. Rankl, and D. S. Barker.

Wyoming Water Planning Program, State Engineer's Office, Cheyenne, Report No. 17, November 1977. 195 p, 2 fig, 9 ref.

Descriptors: \*Rainfall-runoff relationships, \*Small watersheds, \*Ephemeral streams, \*Wyoming, \*Design data, \*Drainage systems, \*Highways, \*Bridge design, \*Thunderstorms, \*Streamflow, \*Peak discharge, \*Hydrographs.

Data for 392 rainfall and runoff occurrences in Wyoming are tabulated for years 1965 to 1973 for small, ephemeral streams having drainage areas of less than 11 square miles. Precipitation and discharge data, in 5-minute increments, are given for 392 flow events in 22 small-drainage basins. The data were collected for use in design of drainage structures for highways crossing ephemeral streams with small drainage areas. (Woodard-USGS) W78-07349

#### PRELIMINARY DIGITAL MODEL OF THE ARIKAREE AQUIFER IN THE SWEETWATER RIVER BASIN, CENTRAL WYOMING,

Geological Survey, Cheyenne, WY. Water Resources Div.

For primary bibliographic entry see Field 2F.

W78-07351

#### ANALYSIS OF WASTE-LOAD ASSIMILATIVE CAPACITY OF THE YAMPA RIVER, STEAM-BOAT SPRINGS TO HAYDEN, ROUTT COUNTY, COLORADO,

Geological Survey, Lakewood, CO. Water Resources Div., and Colorado Department of Health, Denver.

For primary bibliographic entry see Field 5B.

W78-07356

#### DESCRIPTION OF WELLS AT BEALE AIR FORCE BASE AND VICINITY, CALIFORNIA,

Geological Survey, Menlo Park, CA. Water Resources Div.

For primary bibliographic entry see Field 4B.

W78-07358

#### DALLAS URBAN RUNOFF, STORM OF FEBRUARY 11, 1977.

Dallas Water Utilities Dept., TX. Operations Analysis Div.

For primary bibliographic entry see Field 2B.

W78-07361

#### GENERATION OF UNGAGED STREAMFLOW DATA,

Saskatchewan Univ., Regina. Dept. of Civil Engineering.

For primary bibliographic entry see Field 2A.

W78-07384

#### GROUNDWATER RECHARGE AND COASTAL DISCHARGE FOR THE NORTHWEST COAST OF THE ISLAND OF HAWAII: A COMPUTERIZED WATER BUDGET APPROACH,

Hawaii Univ., Honolulu. Water Resources Research Center.

For primary bibliographic entry see Field 2F.

W78-07394

#### HANDBOOK-INDEX OF HAWAII GROUND-WATER AND RESOURCES DATA, EXTRACTED FROM REPORTS OF THE WATER RESOURCES RESEARCH CENTER, UNIVERSITY OF HAWAII, VOLUME I,

Hawaii Univ., Honolulu. Water Resources Research Center.

J. F. Mink.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 794. Price codes: A06 in paper copy, A01 in microfiche. Technical Report No. 113, September, 1977, 119 p. OWRT A-061-HI(1), 14-34-0001-6012.

Descriptors: \*Technology transfer, \*Groundwater data sets, \*Design criteria, \*Design standards, \*Hawaii, \*Hawaii, \*Data collections, \*Bibliographies, \*Information exchange.

The research of the Hawaii Water Resources Research Center covers all aspects of water resources investigations, in the course of which considerable new significant data are generated and older data reevaluated. These data are included in the basic technology transfer documents of the Center, the Technical Reports. To make it easier for the user—the engineer, hydrologist, environmentalist—seeking specific information from the nearly 100 reports published, the transfer of information is made in this Handbook-Index. The transfer of data sets from original publications is restricted, in this first volume, to groundwater matters; however, an index of all significant water resources data sets in the Technical Reports is also

### Group 7C—Evaluation, Processing and Publication

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN AUSTRALIA,**  
Snowy Mountains Engineering Corp., Cooma  
(Australia).  
For primary bibliographic entry see Field 2A.  
W78 .07699

Descriptors: \*Flow control, \*Flow measurement, \*Mathematical models, \*Flow profiles, \*Flood

During the spring and summer of 1976, two municipal-supply wells (designated as well 21 and well 22 - 2,000 feet apart) were drilled at the Post Headquarters area of White Sands Missile Range, New Mexico. The design specifications for both wells called for 24-inch diameter surface casing cemented in place to a depth of about 430 feet, with 16-inch liner and slotted casing from the surface to a depth of about 700 feet. Each well was pumped continuously for 32 hours in a step-drawdown test.

Descriptors  
tanks, Hydro  
Reservoir  
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This test consisted of four steps, with discharge rates varying from about 500 to 1,150 gallons per minute. The drawdown test for well 21 gave an estimated transmissivity of 17,300 gallons per day per foot, and a final specific capacity of slightly less than 11 gallons per minute per foot of drawdown. The step-drawdown test and later drawdown and recovery test on well 22 gave an average transmissivity of 32,600 gallons per day per foot, and a final specific capacity of about 15 gallons per minute per foot of drawdown. The data collected indicated that the aquifer in the vicinity of well 22 is more permeable than the aquifer around well 21. Both wells furnish a satisfactory quantity of excellent-quality water. The dissolved-solids content of water from wells 21 and 22 is 232 and 301 mg/liter respectively. (Woodard-USGS)  
W78-07352

**LINED: A ONE DIMENSIONAL MULTIREACH SEDIMENT TRANSPORT MODEL,**  
Oak Ridge National Lab., TN. Computer Sciences Div.  
For primary bibliographic entry see Field 2J.  
W78-07363

**FIRST FOUR DECADES OF THE HYDRAULICS DIVISION,**  
Iowa Univ., Iowa City.  
For primary bibliographic entry see Field 2A.  
W78-07382

**VORTEX-SHEDDING FLOWMETERS.**  
For primary bibliographic entry see Field 7B.  
W78-07459

**LINEAR AND NONLINEAR WAVE ACTION ESTIMATES,**  
Oregon State Univ., Corvallis. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 2L.  
W78-07485

**SEDIMENTATION OF RIVER NAVIGATION CHANNELS,**  
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.  
For primary bibliographic entry see Field 2J.  
W78-07486

**ORIFICE EFFECTS ON OSCILLATORY FLOW,**  
Saint Johns River Water Management District, Palatka, FL.  
C.H. Tai, and Y. S. Yu.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY4, Proceedings Paper 13702, p 461-469, April 1978. 3 fig, 1 tab, 16 ref.  
W78-07487

Descriptors: \*Orifices, Effects, \*Flow, Water tanks, Hydraulics, Unsteady flow, Reservoirs, Reservoir stages, Mathematical studies, \*Oscillatory flow, Free oscillation flow, Added-mass coefficient, Free oscillation.

The resistance and added-mass effects of an orifice on the free oscillation of water in two tanks interconnected with a pipe orifice were studied at orifice-pipe diameter ratio  $d/D=0.25, 0.53, 0.75$ , and  $1.0$  and  $L/D$  ( $L$ =pipe length) ranging from  $6.0$  to  $28.75$ . A one-dimensional method of solution which accounts for the resistance and added-mass effects was used to compute the displacement of water surface in the tank. The good agreement between the computed and measured displacement curves confirms that the one-dimensional analysis predicts accurately the nonlinear oscillation. In particular, the quasi-steady flow assumption on orifice resistance is justified, and the added-mass effect can be represented by a lumped added-mass coefficient. (Lee-ISWS)  
W78-07487

**CIRCUMFERENTIAL DIFFUSION IN PIPE MIXING,**  
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.  
E. R. Holley, and A. M. Ger.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY4, Proceedings Paper 13663, p 471-485, April 1978. 4 fig, 2 tab, 21 ref, 2 append.

Descriptors: \*Diffusion, \*Pipe flow, \*Mixing, \*Model studies, Mathematical models, Dispersion, Turbulent flow, Pipes, Flow, Variability, Hydraulics, Circumferential diffusion, Pipe mixing.

A method was presented and used for evaluating an average circumferential mass diffusivity for steady, uniform, turbulent pipe flow. The method was based on the analytical solution of the conservation equation for a source at an arbitrary point in a pipe cross section. This solution showed that the asymptotic longitudinal variation of the coefficient of variation of the concentration distribution is a function only of the ratio of the circumferential and the radial diffusivities. Thus, empirical information on this variation can be used to evaluate mass diffusivity. The value obtained for mass diffusivity depends on the value used for radial diffusivity. The eddy viscosity was used to evaluate the latter. Fifteen sets of concentration measurements from three references were used in the analysis. (Sims-ISWS)  
W78-07488

**FORCED PLUMES IN A STRATIFIED RESERVOIR,**  
Salford Univ. (England). Dept. of Civil Engineering.  
B. Henderson-Sellers.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY4, Proceedings Paper 13658, p 487-501, April 1978. 9 fig, 4 tab, 16 ref, 3 append.

Descriptors: \*Reservoirs, \*Stratification, \*Jets, \*Pumped storage, Model studies, Mathematical models, Mathematics, Temperature, Water temperature, Density, Lakes, Water quality, Entrainment, Flow, Velocity, Currents(Water), Hydrodynamics, Plumes.

A comprehensive two- or three-dimensional model for a forced plume was described in which there are no restrictions necessary in the choice of cross sectional velocity or density profiles, angle of efflux, values of initial momentum, and buoyancy fluxes or the ambient stratification. The introduction of such an inflow into a reservoir was shown to affect the stratification, and if 'jetting' is undertaken, destratification results. (Sims-ISWS)  
W78-07489

**TWO-DIMENSIONAL PLUME IN UNIFORM GROUND-WATER FLOW,**  
Massachusetts Inst. of Tech. Cambridge. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5B.  
W78-07490

**DRAG ON BAFFLE WALLS IN HYDRAULIC JUMP,**  
Roorkee Univ. (India). Dept. of Civil Engineering.  
D. M. Tyagi, P. K. Pande, and M. K. Mittal.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY4, Proceedings Paper 13677, p 515-525, April 1978. 9 fig, 6 ref, 2 append.

Descriptors: \*Hydraulic jump, \*Drag, \*Baffles, Laboratory tests, Open channel flow, Settling basins, Loads(Forces), Fluctuations, Flow, Strain gages, Data processing, Hydraulics.

The drag force experienced by a two-dimensional baffle wall at different locations in a forced hydraulic jump was measured. Both the average and fluctuating components of this force were obtained using a drag frame with strain gages as the transducing element. A force coefficient using the free jump sequent depth pressure force was used to correlate the drag force with the relevant parameters. The drag fluctuations were analyzed using the root-mean-square value of the fluctuations as they are found to follow a normal distribution. A unified plot for the average drag force coefficient was obtained using the data collected and some data available in literature. Results obtained were compared with similar results available for three-dimensional baffle blocks. (Sims-ISWS)  
W78-07491

**DESIGN OF CONSTANT ACCURACY LINEAR PROPORTIONAL WEIR,**  
Indian Inst. of Science, Bangalore. Dept. of Civil Engineering.  
K. K. Murthy, and K. G. Pillai.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY4, Proceedings Paper 13705, p 529-541, April 1978. 7 fig, 2 tab, 10 ref.

Descriptors: \*Flow measurement, \*Weirs, \*Design, Hydrometry, Hydraulics, Hydraulic equipment, Equipment, Mathematical studies, Foreign research, Slopes, \*Linear proportional weirs, Sutro weirs.

Five different shaped weirs were designed, and pertinent data for their use were given. One of these weir shapes had the least 'sharp edge' at the junction of the base weir and 'complementary weir.' Two other types of weirs had equal slopes at the junction of the base weir and complementary weir. Another shape, for which neither the indication accuracy was constant nor the slope was equal at the junction of the base weir and complementary weir, also was tested. The results of the four weir shapes hydraulically tested gave consistent values for the coefficient of discharge varying between  $0.625$  to  $0.631$ . The indication accuracies of all the previously designed linear proportional weirs (including Sutro weir) are neither constant nor unity, as was believed. (Lee-ISWS)  
W78-07492

**HOT DRY ROCK GEOTHERMAL ENERGY DEVELOPMENT PROJECT: ANNUAL REPORT, FISCAL YEAR 1977.**  
Los Alamos Scientific Lab., NM.  
Report No. LA-7109-PR, issued February, 1978. 293 p, 168 fig, 31 tab, 96 ref, 2 append.

Descriptors: \*Geothermal studies, \*Hot dry rock, \*Thermal power, Drilling, \*Hydraulic fracturing, Heat transfer, Heated water, Rock properties, Leaching, Fluid flow, Retardance, Fractures(Geology), Boreholes, Directional drilling, Geothermal wells, Logging(Recording), Acoustics, Mathematical models, Equipment, Environmental effects.

The Hot Dry Rock geothermal power concept under investigation at the Los Alamos Scientific Laboratory requires that a borehole be drilled into low-permeability, hot crystalline rock, that a large hydraulic fractured area be produced, and that a second borehole be directionally drilled to intersect the fractured zone. Pressurized water pumped down one borehole is recovered through the other, and energy from the circulated water is extracted via heat exchangers. At the beginning of Fiscal Year 77, two holes had been drilled and both fractured, yet the impedance of the system was too great to permit adequate fluid circulation. Attempts to lower impedance by leaching out quartz in the formation with sodium carbonate proved unsuccessful, thus, the first borehole was redrilled twice to intersect the fractured zone differently;



## Field 8—ENGINEERING WORKS

### Group 8B—Hydraulics

the second redrilling brought about the desired results. In September, 1977, a 96 hour test run of the energy extraction system was completed during which extracted power reached 3.2 MW (thermal) and surface fluid temperatures registered 130 degrees C. The rate of water loss decreased steadily during the run, no induced seismicity was observed, and an encouraging total dissolved solid level of 400 ppm for the circulated water was noted. Significant developments in downhole high-temperature drilling technology were incidental to the project. (Eberle-NWWA) W78-07572

**WELL FIELD MANAGEMENT,**  
Moody and Associates, Meadville, PA.  
For primary bibliographic entry see Field 4B.  
W78-07577

**IMPROVEMENTS FOR LITTLE RIVER INLET, SOUTH CAROLINA; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
W. C. Seabergh, and E. F. Lane.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A049 639. Price codes: A06 in paper copy, A01 in microfiche. Technical Report H-77-21, December 1977. 298 p, 9 tab, 142 pl, 65 photo, 12 ref.

Descriptors: \*Channel improvement, \*Hydraulic models, \*Inlets (Waterways), \*Jetties, \*South Carolina, \*Little River Inlet(SC), \*Tidal inlets, \*Fixed-bed models.

Little River Inlet, located near the State border of North and South Carolina is a natural channel through the coastal barrier beach that conducts tidal flows between the Atlantic Ocean, inner channels, and a lagoon approximately 6 square miles in size. Improvements for the inlet were authorized on 12 October 1972 and included two jetties, sand transition dikes connecting the structures to the shore, a 300-ft-wide by 12-ft-deep entrance channel through the offshore bar, and a 90-ft-wide by 10-ft-deep inner channel from the entrance channel to the Atlantic Intercoastal Waterway. A model study was performed to aid in preconstruction planning and design of the structures and included an investigation of items such as optimum alignment, length and spacing of the jetties, current patterns and magnitudes, sediment movement patterns, effects on the tidal prism, and effects on bay salinities. Model testing concluded that Plan 2D-1 which included weir sections backed by deposition basins for both jetties would be the most feasible plan. (WES) W78-07671

**PHYSICAL HYDRAULIC MODELS: ASSESSMENT OF PREDICTIVE CAPABILITIES; REPORT 2, MOVABLE-BED MODEL OF GALVESTON HARBOR ENTRANCE,**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
J. V. Letter, Jr., and W. H. McAnally, Jr.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 988. Price codes: A09 in paper copy, A01 in microfiche. Research Report H-75-3, November 1977 (Report 2 of a series). 192 p, 20 tab, 75 pl, 22 ref, 1 append.

Descriptors: \*Hydraulic models, \*Harbors, \*Dredging, Texas, \*Galveston Harbor(Tex), \*Moveable-bed models, \*Navigation channels.

Movable-bed physical hydraulic model predictions of sedimentation effects arising from channel realignment and deepening in Galveston Harbor entrance, Texas, is evaluated. Comparisons of model predictions and observed behavior for 6 years following completion of channel realignment showed that qualitative predictions of an arrest of

undermining of the north jetty were correct and that the predicted relative increase in total maintenance dredging was reasonably close. Detailed analysis showed that absolute model predictions of dredging volumes were somewhat low in the approach channel, essentially correct in the outer bar channel, and considerably low in the inner bar channel. Locations of scour and fill were accurately predicted for the navigation channel but volumes of the changes were underestimated by the model. Large zones of scour and fill in the entrance were approximately similar in model and prototype. Differences in model and prototype results are believed to be due to scale effects and insufficient prototype data. It is concluded that movable-bed modeling is a feasible, though difficult, technique and that steps to improve model similitude will improve similar future movable-bed model studies. (WES) W78-07672

**PATTERNS OF SUCCESSION IN BENTHIC IN-FAUNAL COMMUNITIES FOLLOWING DREDGING AND DREDGED MATERIAL DISPOSAL IN MONTEREY BAY,**  
Moss Landing Marine Lab. CA.  
For primary bibliographic entry see Field 5C.  
W78-07677

**NEARSHORE NUMERICAL STORM SURGE AND TIDAL SIMULATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
J. J. Wanstrath.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 994. Price codes: A08 in paper copy, A01 in microfiche. Technical Report H-77-17, September 1977. 51 p, 19 tab, 27 ref, 78 pl.

Descriptors: \*Mathematical models, \*Model studies, \*Tides, \*Storm surge, Coasts, Waves(Water).

A two-dimensional, time-dependent, open-coast, long-wave, shallow-water model is presented. The model employs an orthogonal curvilinear coordinate system with telescoping computing cells. This permits greater resolution of the wave in the nearshore coastal region where principal interest is focused rather than at the continental shelf break or at far lateral distances from the region. The model treats the coastline as a finite height barrier which is broken with bay entrances. Coastal overtopping and bay communication with the open sea provide the means for the transport of water across the nominal coastline. Mass is conserved with all water lost from the ocean during the flood stage being stored in discrete bay ponding areas. Each ponding area is described by its particular storage area curve and its particular series of coastline computing grid segments. A prediction/correction method is employed for the computation of the coastal water level. (WES) W78-07679

## 8C. Hydraulic Machinery

**WIND POWERED ARTIFICIAL AERATION OF NORTHERN PRAIRIE LAKES,**  
North Dakota State Univ., Fargo. Dept. of Mechanical Engineering.  
W. G. Rieder.  
North Dakota Water Resources Research Institute, Fargo, Research Report No. W1-222-014-77, December 1977. 114 p, 32 tab, 23 fig, 38 ref, 4 append. OWRB B-040-NDAK(1), 14-34-0001-7177.

Descriptors: \*Aeration, Winds, Model studies, Lakes, Destratification, \*Turbines, \*Artificial aeration, Oxygen requirements, \*Wind-powered compressors, \*North Dakota, \*Northern Prairie Lake(ND AK).

Most northern prairie lakes suffer from reoccurring oxygen depletion, and, although artificial aeration seems to help, operating costs are becoming high because of increasing energy costs. An alternate source of compressed air for operating the aeration system is wind-powered compressors. A detailed assessment of the feasibility of this approach in North Dakota settings was completed. A large number of wind-turbine and compressor combinations was investigated. Methodology for matching commercial compressors to various wind turbines and predicting output rates based on wind spectrum inputs was developed and verified. Optimum gear-up ratios exist for maximum air output rates. A small experimental wind-powered compressed-air system was built and operated successfully at a non-lake site. Economic analyses were completed. Findings indicate that the use of wind to power small compressors (less than about 15 SCFM) for artificial aeration in North Dakota is technically and economically feasible within certain constraints. Recommendations include proceeding into prototype system installations at lake sites in North Dakota for performance and cost monitoring over several years. W78-07201

**SELF CLEANING, PRESSURE RESPONSIVE EMITTER VALVE FOR SOIL IRRIGATION,**  
Salco Products, Inc., Hawthorne, CA. (Assignee).  
For primary bibliographic entry see Field 3F.  
W78-07243

**HISTORY OF SEWAGE PUMPING IN BRITAIN,**  
H. H. Stanbridge.  
Water Pollution Control, Vol. 76, p 517-523, 1977. 67 ref.

Descriptors: \*Pumping plants, \*Pumping, \*Pump turbines, \*Sewage, \*Centrifugal pumps, Hydraulic equipment, Steam, Electric power, Sewerage, Waste water treatment, Municipal wastes, \*History, \*Reviews, \*Bibliographies.

The history of sewage pumping in England, from gravity flow to Archimedeal screw pumps, was presented. Where gravity flow was not feasible, turbine-driven reciprocating pumps were used. Steam-driven beam engines to operate the pumps came into widespread use in the 1880's, followed by the smaller steam-driven reciprocating pumps in 1890. These were eventually powered by steam generated from refuse incinerator heat. Ram or plunger pumps were employed for transporting sewage at pumping stations, followed by pneumatic ejectors. Various sewage lift pumps were developed around the turn of the century, including: the Adams' sewage lift, patented in 1892; air lift pumps; pulsometers; the patented Humphrey pumps; and a windmill-driven lifting pump. Internal combustion engines were replaced by electrically-powered pumps at the beginning of the century. Early centrifugal pumps were modified and improved to create the electrically-driven vertical-spindle centrifugal pumps. Electrically-powered axial-flow pumps, patented in 1927, and mixed-flow pumps were suitable for pumping large volumes of sewage against a low head. Archimedeal screw pumps have been popular in this decade. (Lisk-FIRL) W78-07417

**BORING MACHINES PICK UP SPEED ON DEEP CHICAGO SEWER TUNNELS,**  
Engineering News-Record, Vol. 200, No. 17, p 28-30, April, 1978. 1 fig.

Descriptors: \*Boreholes, \*Tunnel construction, \*Tunneling machines, \*Reservoir construction, Equipment, Grouting, Concrete-lined canals, Sealants, Sewers, Storm water, Conveyance structures, Waste water treatment, Municipal wastes.

Rotary moles up to 35 ft in diameter are being used to bore the 131 miles of deep tunnels and reser-

voirs to control in Chicago. The reservoir project flows is part of Chicago. The with compressed depths to 240 to control growth lined with 10-inch capacity of the mgd. Rotary n (it have maximum disk cutter cavated rock b contractors, Iveyor bridgeveyor in an n posed in excavation the mole cuttermands of the cylinders havefecting operation W78-07423

**THE USE OF WATERING**  
For primary b W78-07426

**MODEL TEST MENTATION**  
Edinburgh U engineering. For primary b W78-07468

**CONSERVE SYSTEMS,**  
Black and Ve For primary b W78-07476

**FLEXODRILL TINUOUSLY**  
For primary b W78-07579

**PACKERS AT Universal O Div. R. L. Moore. Johnson Drill March-April,**

Descriptors: screens, \*We Drilling equip

Three types (1) Lead pack screen to the sandtight sea to attach the screen into expose the se packer against cal-faced dri To minimize little or too m tube) can be screen. (2) K lead packer. The packer l swedging ope seal the annu casing and t conical shape falling down can also be u quality water spotting gro NWWA) W78-07585

vours to control storm and waste water overflows in Chicago, Illinois. The \$2.8 billion tunnel and reservoir project for diverting and retaining overflows is part of a \$5.6 billion plan to upgrade the sewers and waste water treatment facilities in Chicago. The rotary moles bore through limestone with compressive strengths up to 40,000 psi at depths to 240 ft. Grout is injected into the borings to control groundwater influx; the tunnels will be lined with 10-12 inches of concrete. The maximum capacity of the completed tunnels is estimated as 6 mgd. Rotary moles in the diameter range of 18-22 ft have maximum boring rates of 10 ft/hr with single disk cutters. Methods of removing the excavated rock from the tunnels, used by the various contractors, include: crane-lifted hoppers, conveyor bridge assemblies, and a 900 ton/hr conveyor in an inclined shaft. Problems have been posed in excavation by clay deposits which clog the mole cutters and curves. The electrical demands of the power head motors and the thrusting cylinders have been monitored as a means of effecting operation efficiency. (Lisk-FIRL)  
W78-07423

**THE USE OF FILTERBELT PRESSES FOR DEWATERING OF SEWAGE SLUDGES.**  
For primary bibliographic entry see Field 5D.  
W78-07426

**MODEL TESTS OF CIRCULAR SEWAGE SEDIMENTATION TANKS.**  
Edinburgh Univ. (Scotland). Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5D.  
W78-07468

**CONSERVE ENERGY IN WASTEWATER SYSTEMS.**  
Black and Veatch, Detroit, MI.  
For primary bibliographic entry see Field 5D.  
W78-07476

**FLEXODRILL MONITORS BOREHOLE CONTINUOUSLY.**  
For primary bibliographic entry see Field 8G.  
W78-07579

**PACKERS AND SEALS SERVE MANY USES.**  
Universal Oil Products, St. Paul, MN. Johnson Div.  
R.L. Moore.  
Johnson Drillers Journal, Vol 50, No 2, p 4-5, March-April, 1978.

Descriptors: \*Water wells, \*Packers, \*Well screens, \*Well casings, Sealants, Rotary drilling, Drilling equipment.

Three types of water well packers are discussed: (1) Lead packer—used to fasten a telescoping well screen to the inside of the casing and provide a sandtight seal at that point. Common procedure is to attach the packer to the top of the screen, lower the screen into a cased hole, pull back the casing to expose the screen to the formation, and flare the packer against the inside of the casing using a conical-faced driving tool known as a sledge block. To minimize the risk of pulling back the casing too little or too much, a short piece of riser pipe (flush tube) can be attached between the packer and screen. (2) K-type packer—similar function as the lead packer. Flexible rubber rings on the outside of the packer form the seal, thus eliminating the swedging operation. (3) Formation packer—used to seal the annular space between the outside of well casing and the borehole wall, made of rubber, conical shape. Useful in keeping overburden from falling down into rock wells. Formation packers can also be utilized to seal off an aquifer of poor quality water from one of better quality, or for spotting grout at precise locations. (Eberle-NWA)  
W78-07585

**IDENTIFICATION OF ALTERNATIVE POWER SOURCES FOR DREDGED MATERIAL PROCESSING OPERATIONS.**  
Civil Engineering Lab. (Navy). Port Hueneme, CA.

C. E. Parker, D. Pal, K. F. Vodraska, and J. B. Ciani.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A048 312. Price codes: A07 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-32, November 1977. 138 p, 6 append, 37 fig, 10 tab, 32 ref.

Descriptors: \*Dredged material disposal, \*Alternative energy sources, \*Wind power, \*Hydraulic power.

A basis is provided for selecting alternative, renewable power sources specifically for operating dredged material processing systems. A dredged material processing system is designed to: (1) extract sand and gravel for commercial use, (2) remove silt and clay from water to meet quality restrictions on return water, and (3) dewater the residual silt and clay to reduce volume and provide a usable foundation for later land use. Scope of the assigned task was to provide a screening and selection procedure for the engineer designing a dredged material processing system in order to decide which natural form of energy (or combination), if any, should be chosen to power the system. The following sources were considered: wind power, solar radiation, and hydraulic power (waves and currents) for driving electric generators. Of all the alternative power sources studied, wind electric generation seems to be the most practical and versatile to apply at this time. A 12-kw DC wind generator is shown to provide power at Buffalo, New York (best site), for \$0.0243/kw-hr. Though the unit cost of wind-produced electricity is competitive, the present size limit of 12 kw might imply a large number of wind generators at dredging sites. (WES)  
W78-07680

## 8D. Soil Mechanics

**DIELECTRIC CONSTANT AND ELECTROCONDUCTANCE OF SOME DRY FROST-PRONE SOILS.**  
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 2C.  
W78-07369

**APPENDIX E TO CORRELATION OF DUAL-CHANNEL AIRBORNE IR DATA WITH SOIL MOISTURE MEASUREMENTS.**  
Development and Resources Transportation Co., Silver Spring, MD.  
For primary bibliographic entry see Field 2G.  
W78-07383

**DAM OF THE KOLYMA HYDROELECTRIC POWER PLANT.**  
V. G. Petrov, and E. D. Losev.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A034 211. Price codes: A02 in paper copy, A01 in microfiche. CRREL Draft Translation 563, December 1976. 10 p, 3 fig, 1 tab, Translated from Trudy gidroproekta, No. 34, p 78-87, 1973.

Descriptors: \*Dams, \*Cold weather construction, \*Permafrost, Hydroelectric power, Hydroelectric plants, Powerplants, Earth dams, Design, Dam design, Structures, Hydraulic structures, Structural engineering, Soils, Soil physics, Civil engineering, \*USSR, \*Kolyma Hydroelectric Powerplant (USSR).

The site of the Kolyma Hydroelectric Power Plant is in the upper course of the Kolyma River. The natural conditions of the region of construction are extremely difficult. The climate is extremely severe (mean annual temperature -12°C), summer is short, continuous permafrost, heavy spring floods in a narrow channel, far from developed regions of the country—this is a far from complete list of the conditions which complicated the planning and construction of the Kolyma Hydroelectric Power Plant. This report discussed the variety of problems and conditions which complicated the planning and construction of the Kolyma Hydroelectric power plant. The report was written before actual construction began. (Sims-ISWS)  
W78-07511

**TEMPERATURE REGIME OF LOW-HEAD EARTH DAMS IN CENTRAL YAKUTIA.**  
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Gidrotekhniki i Melioratsii, Yakutsk (USSR). D. N. Sleptsov.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A037 024. Price codes: A02 in paper copy, A01 in microfiche. CRREL Draft Translation 582, Jan 1977. 6 p, 3 fig. Translated from Trudy Yakut'skogo Nauchno-Issledovatel'skogo Instituta Sel'skogo Khozyaystva, No. 12, p 87-92, 1972.

Descriptors: \*Earth dams, \*Temperature, \*Cold weather construction, \*Permafrost, Dams, Heat transfer, On-site investigations, Cold regions, Structures, Freezing, Thawing, Irrigation, Earth physics, Civil engineering, \*USSR, \*Central Yakutia (USSR), Thermal regime.

The temperature regime of dams on permafrost foundations is one of the basic factors which insures normal functioning of the structure. The dams of the catchwork irrigation system for meadows and water supply under conditions of Central Yakutia generally have heads of 3-5 meters. This report investigated the temperature regime of such dams. Temperature influences of the banks of the valley and heat from the earth's interior were investigated. Thermal engineering calculation of the extreme temperature state and time of reaching the extreme temperature state of the body of the dam also were explored. (Sims-ISWS)  
W78-07512

**EFFECT OF NONLINEAR AIR FILTRATION ON THERMAL REGIME OF ROCK-FILL DAM.**  
N. A. Mukhetdinov.  
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 092. Price codes: A02 in paper copy, A01 in microfiche. CRREL Draft Translation 580, January 1977. 15 p, 5 fig, 1 tab, 12 ref. Translated from Izvestiya Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Gidrotekhniki, Vol 96, p 205-217, 1971.

Descriptors: \*Earth dams, \*Rockfill dams, \*Temperature, Model studies, Laboratory tests, Mathematical models, Computer models, Air temperature, Heat transfer, Dams, Filtration, Permeability, Porous media, Soils, Soil physics, Thermal regime.

Empirical dependences were obtained for determining the coefficients of permeability and turbulent filtration in a large-pore medium. A methodology was proposed for numerical solution to the nonlinear problem of air filtration in an isotropic large-pore medium. When the nonlinearity of air filtration in pores under conditions of natural convection is considered, the rate of change in the temperature of the lower prism of a rockfill dam decreases. (Sims-ISWS)  
W78-07513

## Field 8—ENGINEERING WORKS

### Group 8D—Soil Mechanics

#### CALCULATIONS OF THE THERMAL REGIME OF EARTHEN DAMS CONSIDERING THEIR CONSTRUCTION BY LAYERS,

R. T. Shugayeva.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A034 189. Price codes: A02 in paper copy, A01 in microfiche. CRREL Draft Translation 565, December 1976. 11 p, 5 fig, 2 tab, 7 ref. Translated from *Izvestiya Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Gidrotekhniki*, Vol 96, p 218-224, 1976.

Descriptors: \*Earth dams, \*Cold weather construction, \*Temperature, \*Model studies, Mathematical models, Equations, Computer models, Heat transfer, Soil physics, Dams, Cold regions, Freezing, Thawing, Permafrost, Civil engineering, \*Thermal regime(Dams).

The planning and construction of water engineering structures under severe climatic conditions place increased requirements on investigation of the thermal regime of these structures, both during the period of construction and the period of use. A detailed study was presented which investigated a number of calculations in the determination of the thermal regime of impervious earthen dams and their bases during the period of construction and the first years of use, considering the fact that they are constructed in layers. These calculations can be reduced to solution of the problem of freezing and thawing of soils in areas of complex configuration, the dimensions of which change during the process of calculation. (Sims-ISWS) W78-07514

#### CONTAINMENT AREA MANAGEMENT TO PROMOTE NATURAL DEWATERING OF FINE-GRAINED DREDGED MATERIAL,

Army Engineer Waterways Experiment Station, Vicksburg, MS.

For primary bibliographic entry see Field 5E.

W78-07673

#### SIZING OF CONTAINMENT AREAS FOR DREDGED MATERIAL,

Massachusetts Inst. of Tech., Cambridge, MA.

Constructed Facilities Div.

For primary bibliographic entry see Field 5E.

W78-07674

### 8E. Rock Mechanics and Geology

#### CONCRETE FOR BUILDING DAMS ON A ROCK FOUNDATION AS IT RELATES TO THE PROBLEM OF CRACK RESISTANCE UNDER SEVERE CLIMATIC CONDITIONS,

For primary bibliographic entry see Field 8F.

W78-07362

#### HOT DRY ROCK GEOTHERMAL ENERGY DEVELOPMENT PROJECT: ANNUAL REPORT, FISCAL YEAR 1977.

Los Alamos Scientific Lab., NM.

For primary bibliographic entry see Field 8B.

W78-07572

### 8F. Concrete

#### CONCRETE FOR BUILDING DAMS ON A ROCK FOUNDATION AS IT RELATES TO THE PROBLEM OF CRACK RESISTANCE UNDER SEVERE CLIMATIC CONDITIONS,

V. V. Stol'nikov.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A028 066. Price codes: A03 in paper copy, A01 in microfiche. CRREL Draft Translation 536, August 1976. 26 p. Translated from *Izvestiya Vsesoyuz-*

*nogo nauchno-issledovatel'skogo instituta gidrotekhniki*, Vol 79, p 20-40, 1965.

Descriptors: \*Dams, \*Concretes, \*Cold weather construction, Concrete dams, Concrete technology, Concrete structures, Hydraulic structures, Concrete mixes, Cements, Additives, Fly ash, Pozzolans, Cold regions, Frost, Frost action, Frost protection, Civil engineering.

The article examined the pressing problem of designing concrete for building dams on rock foundations as it relates to the problem of crack resistance under severe climatic conditions. The article advanced and examined a new trend in conducting scientific research work for providing homogeneity of the concrete and continuity of massive concrete hydrotechnical structures. The trends consist in the extensive combined approach to solving the basic problem of achieving crack resistance and in examining the individual problems of concrete that derive from the struggle with crack formation. The article examined general aspects of the problem, problems of choosing cements, specifications for fillers, and questions of the homogeneity of the concrete of hydrotechnical structures. Appropriate recommendations also were made. (Sims-ISWS) W78-07362

#### WASTEWATER EFFLUENT LINE SERVES DUAL PURPOSE,

Brownsville Public Utilities Board, TX.

For primary bibliographic entry see Field 5E.

W78-07419

#### MODULAR TREATMENT PLANT.

For primary bibliographic entry see Field 5D.

W78-07659

### 8G. Materials

#### DRILLING, CONSTRUCTION, AND TESTING OF WATER-SUPPLY WELLS 21 AND 22, WHITE SANDS MISSILE RANGE, DONA ANA COUNTY, NEW MEXICO,

Geological Survey, Albuquerque, NM. Water Resources Div.

For primary bibliographic entry see Field 8B.

W78-07352

#### PIPING MATERIALS: LITTLE FUROR; SOME CHANGE.

Domestic Engineering, Vol. 231, No. 3, p 64-67, March, 1978. 2 tab.

Descriptors: \*Plastic pipes, \*Metal pipes, \*Rubber pipes, \*Construction materials, \*Sewers, Water conveyance, Pipelines, Distribution systems, Domestic water, Sewerage, Waste water treatment, Municipal wastes, Building codes.

Results of the 1978 Domestic Engineering Plumbing Code Survey on the permitted uses of various pipe types and materials were discussed. The survey was conducted for polyvinyl chloride pipe, polybutylene and polypropylene pipe, acrylonitrile-butadiene-styrene pipe, bituminous fiber, and cast iron pipe. The percentage of surveyed municipalities allowing plastic house sewer lines were: 59% for acrylonitrile-butadiene-styrene, 58% for schedule 40 polyvinyl chloride, 54% for D-3034 polyvinyl chloride, and 47% for bituminous fiber. Other uses allowed for the pipes surveyed included: house-street water lines, hot-cold water lines, single family homes, apartments, and commercial buildings. Of the 42 municipalities responding to the survey, 30 prohibited the use of polybutylene for hot-cold water lines. Chlorinated polyvinyl chloride was not allowed for hot-cold water lines by 23 of the cities; 27 prohibited the use of bituminous fiber pipes. Of the pipes surveyed, polyvinyl chloride and acrylonitrile-bu-

tadiene-styrene were allowed for above ground use by 21 and 20 of those responding, respectively. Cast iron soil pipe was sanctioned for all uses by all those responding except four. (Lisk-FIRL) W78-07414

#### GRP PIPE FOR SEWAGE DISCHARGE AT SEA,

Pipes and Pipelines International, Vol. 22, No. 5, p 31-32, October, 1977.

Descriptors: \*Pipes, \*Plastic pipes, \*Steel pipes, \*Metal pipes, \*Outlet works, Pipelines, Construction materials, Sewage disposal, Hydraulic structures, Waste water disposal, Municipal wastes.

Fiberglass-reinforced plastic pipes (GRP) were used to construct a 1,507 m underwater municipal sewage outfall pipeline in La Pointe Simon, Martinique. The 9 mm thick pipes were reinforced with filament wound fiberglass. One hundred meter sections, each with a 609 m diameter, were connected on shore with glued bell and spigot joints and towed into position. The sections of pipe were tested at hydrostatic pressures of 2-3 bars before and after installation. The complete project required 10 workers, 7 months, and half the estimated cost for steel pipelines. Steel pipelines for the sewer outfall were rejected because of prohibitive installation costs, including: towing, welding, and protective linings. Cast iron pipe was rejected for its excessive weight and inflexibility. The fiberglass-reinforced plastic pipes are as strong and impervious as metal pipes. (Lisk-FIRL) W78-07415

#### DUCTILE-IRON PIPE GALLERY.

Pipes and Pipelines International, Vol. 22, No. 2, p 10-11, April, 1977.

Descriptors: \*Treatment facilities, \*Metal pipes, \*Iron, Sedimentation, \*Settling basins, Construction materials, Corrosion control, Protection, Intakes, Pipes, Sludge treatment, Sludge disposal, Sewers, Sewerage, Valves, Plastic pipes, Waste water treatment, Municipal wastes.

A waste water treatment plant, under the jurisdiction of England's Yorkshire Water Authority, utilizes ductile iron pipe protected beneath a gallery for the inlets and outlets to the sedimentation tanks. The horizontality of the area allowed the sedimentation tanks as well as other treatment units to be constructed above ground. The 3 m height of the water surface in the sedimentation tank allowed for the construction of a covered gallery to protect the ductile pipe sludge removal, effluent feed, and surface water pipes. The gallery also created a protected working area for the plant operators. The corrosion-resistant pipes included: flanged, flanged tapers, tee-junctions, and 90 degree bends. Specially-designed fiberglass-reinforced plastic ports to the sedimentation tanks diffuse the influent to enhance solids settling. A control station contains a portable for sludge monitoring; electro-hydraulic actuators for desludging valves are push-button controlled from the gallery. The treatment facility is designed to treat wastes from a population of 58,000. (Lisk-FIRL) W78-07416

#### SEWERS... THE CLEANER, THE BETTER.

American City and County, Vol. 93, No. 4, p 43-44, 46, 48, April, 1978.

Descriptors: \*Sewers, \*Sewerage, \*Cleaning, Equipment, \*Conveyance structures, Hydraulic equipment, Bacteria, Chemicals, Root systems, Rotary drilling, Waste water treatment, Municipal wastes.

An evaluation of sewer cleaning techniques includes bucket machines, rodding equipment, high velocity water jets, hydraulic balls and hinged discs, plain flushing, chemicals, and bacteria. Bucket machines for removing all types of heavy

debris require While the bucket restore the hydraulic misalignment, but interfere with the steel rotating speed and a velocity flexibility or efficiency. The and hinged disc hydraulic pressure built up by the high velocity water source at 60 gpm modification of growth in sewer chemicals as for sewer to retard flushing with primarily in lines. Bacteria of lift stations, in treatment (FIRL) W78-07420

#### GROUTING EFFECTIVE

Wichita Sewer

L.L. Penner.

Water and Sewer

67, March, 1977

Descriptors:

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## SCIENTIFIC AND TECHNICAL INFORMATION—Field 10

### Preparation Of Reviews—Group 10F

debris require cables to connect the manholes. While the bucket units and porcupine brushes restore the hydraulic capacity of the sewer pipes, misalignment, broken pipe, or intruding laterals interfere with the cleaning operation. Flexible spring steel rotating rods provide adjustable driving speed and a variety of specialized attachments, but flexibility can provide a significant margin of inefficiency. The plastic or rubber hydraulic balls and hinged disc cleaning units operate on the hydraulic pressure of the waste water which is built up by blocking the downstream flow. The high velocity water jet which supplies a water source at 60 gpm at a pressure of 100 psi is a modification of this method. Inhibiting root growth in sewers is accomplished by introducing chemicals as fumigants or foams into a blocked sewer to retard root growth for several years. Plain flushing with fire hydrant hoses is effective primarily in flat areas and near the ends of sewer lines. Bacteria have been used more for cleaning of lift stations, filters, sludge digestors, and grease in treatment plants than in sewer lines. (Lisk-FIRL)  
W78-07420

#### GROUTING PROVIDES ECONOMICAL AND EFFECTIVE MAINTENANCE IN KANSAS, Wichita Sewer Maintenance Office, KS.

L.L. Penner.  
Water and Sewage Works, Vol. 125, No. 3, p 66-67, March, 1978.

Descriptors: \*Chemical grouting, \*Sewers, \*Storm drains, \*Inspection, \*Leakage, Construction materials, Sealants, Infiltration, Joints(Connections), Sewerage, Waste water disposal, Municipal wastes.

A program of chemical grouting and television inspection of leaks and defects in sewage pipes has been implemented in Wichita, Kansas. The 1,100 miles of sanitary sewers and 180 miles of storm sewers in Wichita are subject to damage by the extremes in temperature, precipitation, and soil conditions. Infiltration of the pipes, which were originally sealed with tar at the joints, was encountered in approximately 67% of the sewer system due to the dissolution of air bubbles in the tar seals after heavy precipitation. AM-9 chemical grout, manufactured by American Cyanamid Co., is applied to the interior of the leaking pipe joint with a pressure sleeve. The chemical grout forms a gel which seals the leak and stabilizes the surrounding soil. The setting time of the gel is controlled by the amount of catalyst added to the grout solution; the amount of grout required to repair a joint leak is calculated in a number of gallons equivalent to half the pipe diameter in inches. Once the grouting is accomplished, a four-person crew feeds the television into the sewer line to inspect the pipe repair. The grouted joints have been reported to withstand a variety of soil conditions, including quicksand. The total cost of grouting and inspecting a sewer joint is estimated to be \$11. (Lisk-FIRL)  
W78-07421

#### PVC PIPE PASSES PERFORMANCE AND COST TESTS,

Certain-Teed Corp., Valley Forge, PA. Pipe and Plastics Group.  
E.J. Lawless.  
Water and Sewage Works, Vol. 124, No. 12, p 52-53, December, 1977.

Descriptors: \*Plastic pipes, \*Trenches, \*Excavation, \*Deflection, \*Structural behavior, Construction materials, Installation, Conduits, Sewerage, Cleaning, Waste water treatment, Construction materials, Installation, Conduits, Sewerage, Cleaning, Waste water treatment, Gravels, Sands, Municipal wastes.

The methods of installing flexible polyvinyl chloride pipe and pipe performance under stress

and use are reviewed. For sewer conduit installations, polyvinyl chloride pipe requires proper bedding and backfill compaction. The pipe must be installed in a flat-bottomed, stable trench. For class 1 bedding materials, stone or gravel, the flexible pipe receives adequate side support without additional compaction; class 2 bedding, or sand, requires thorough tamping of the sides when backfill material from the trench excavation is used. Mandril testing for pipe deflection is required for trench excavations of 20-30 ft, where trench conditions are unstable, or where installation has been difficult. Deflection of the pipe after installation occurs within the first month, after which the pipe and soil conditions stabilize. Polyvinyl chloride pipe allows on-site cutting with a handsaw, easy tie-ins, and uncomplicated saddles for subsequent cut-ins. Although cleaning of the pipe is rarely necessary, hydraulic equipment of electric augers are efficient and do not damage the pipe. (Lisk-FIRL)  
W78-07479

#### SEWAGE SYSTEM REJUVENATION.

Western Construction, Vol. 53, No. 4, p 16, April, 1978.

Descriptors: \*Pipes, \*Culverts, \*Intakes, \*Steel pipes, \*Copper, Corrosion control, Conveyance structures, Treatment facilities, Waste water treatment, Municipal wastes, Construction materials.

Inland Steel Company's Blac-Klad Laminated Culvert Stock was used for all conveyance structures used in the upgrading of the Glendive, Montana, sewage treatment plant. Treatment included primary skimming and biological treatment in open lagoons aerated with open baffled flumes. The inlet culvert, the access manholes, and the aerating open flume were constructed of the Blac-Klad culvert stock. Corrugated .064 gauge steel sheets were rolled into culverts ranging in size from 18-60 inches. Exposed areas, especially riveting or welding, were coated with an asphalt base primer. The steel sheets were constructed of 2-oz galvanized copper-bearing culvert steel capable of withstanding the effects of the corrosive waste water. Blac-Klad culvert stock pipe is also manufactured in 12, 14, 16, and 18 gauge with a copolymer laminated coating. (Lisk-FIRL)  
W78-07535

#### FLEXODRILL MONITORS BOREHOLE CONTINUOUSLY.

Oil and Gas Journal, Vol. 76, No. 20, p 68-71, May 15, 1978, 7 fig.

Descriptors: \*Rotary drilling, \*Drilling equipment, \*Telemetry, Continuous drill string, Flexible drill string.

Institut Francais du Petrole, Rueil-Malmaison, France, has developed a rig which uses a continuous flexible drill string. The rig (called Flexodrill) has two major advantages over conventional rotary drilling systems: (1) the capability of continuous tripping of the drill string while remaining, running in, or pulling out without ever stopping mud circulation; (2) telemetry and remote control of the down-hole equipment with hard wire at all times. The IFP Flexodrill project began in 1960, and since that time, many holes have been successfully drilled up to the 10,000-foot range. Directional drilling with the system has also proved effective. In its present stage, Flexodrilling is fully operational and has satisfactory reliability down to 6,000 ft. Further experience is still needed to improve reliability between 6,000 and 10,000 ft., as well as to more fully assess the economics of the system. (Eberle-NWAA)  
W78-07579

**POSITIONING TECHNIQUES AND EQUIPMENT FOR U. S. ARMY CORPS OF ENGINEERS HYDROGRAPHIC SURVEYS,**  
Army Engineer Waterways Experiment Station, Vicksburg, MS.  
For primary bibliographic entry see Field 7B.  
W78-07676

### 81. Fisheries Engineering

**NORTHERN PIKE PRODUCTION IN MANAGED SPAWNING AND REARING MARSHES,**  
Wisconsin Dept. of Natural Resources, Madison, Bureau of Research.  
For primary bibliographic entry see Field 5C.  
W78-07293

## 10. SCIENTIFIC AND TECHNICAL INFORMATION

### 10C. Secondary Publication And Distribution

**NITRIFICATION AND NITROGEN REMOVAL,**  
Corning Glass Works, NY.  
For primary bibliographic entry see Field 5D.  
W78-07215

**TIDAL MARSH BIBLIOGRAPHY, SELECTED KEY WORK INDEX (PARTIALLY ANNOTATED),**  
Delaware Univ., Newark. Coll. of Marine Studies.  
For primary bibliographic entry see Field 2L.  
W78-07226

**HISTORY OF SEWAGE PUMPING IN BRITAIN,**  
For primary bibliographic entry see Field 8C.  
W78-07417

### 10D. Specialized Information Center Services

**HANDBOOK-INDEX OF HAWAII GROUND-WATER AND RESOURCES DATA, EXTRACTED FROM REPORTS OF THE WATER RESOURCES RESEARCH CENTER, UNIVERSITY OF HAWAII, VOLUME I,**  
Hawaii Univ., Honolulu. Water Resources Research Center.  
For primary bibliographic entry see Field 7C.  
W78-07395

### 10F. Preparation Of Reviews

**NITRIFICATION AND NITROGEN REMOVAL,**  
Corning Glass Works, NY.  
For primary bibliographic entry see Field 5D.  
W78-07215

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH: INTERNATIONAL SUMMARY,**  
American Society of Civil Engineers, New York.  
For primary bibliographic entry see Field 2A.  
W78-07689

**URBAN HYDROLOGICAL MODELING AND CATCHMENT RESEARCH IN INDIA,**  
Indian Inst. of Tech., Kanpur; and Indian Agricultural Research Inst., New Delhi.  
For primary bibliographic entry see Field 2A.  
W78-07690

## Field 10—SCIENTIFIC AND TECHNICAL INFORMATION

### Group 10F—Preparation Of Reviews

**URBAN RUNOFF RESEARCH IN POLAND,**  
Research Inst. on Environmental Development,  
Warsaw (Poland).  
For primary bibliographic entry see Field 2A.  
W78-07691

**URBAN HYDROLOGICAL MODELING AND  
CATCHMENT RESEARCH IN THE NETHER-  
LANDS,**  
Rijksdienst voor de IJsselmeerpolders, Lelystad  
(Netherlands).  
For primary bibliographic entry see Field 2A.  
W78-07692

**URBAN HYDROLOGICAL MODELING AND  
CATCHMENT RESEARCH IN NORWAY,**  
Norges Vassdrags- og Elektrisitetsvesen, Oslo.  
Hydrological Div.  
For primary bibliographic entry see Field 2A.  
W78-07693

**URBAN HYDROLOGICAL MODELING AND  
CATCHMENT RESEARCH IN FRANCE,**  
Montpellier-2 Univ. (France). Lab. d'Hydrologie  
Mathematique.  
For primary bibliographic entry see Field 2A.  
W78-07694

**URBAN HYDROLOGICAL MODELING AND  
CATCHMENT RESEARCH IN SWEDEN,**  
Lund Inst. of Tech. (Sweden); and Dept. of Water  
Resources Engineering.  
For primary bibliographic entry see Field 2A.  
W78-07695

**URBAN HYDROLOGY STUDIES AND MATHE-  
MATICAL MODELING IN THE FEDERAL  
REPUBLIC OF GERMANY,**  
Landesanstalt fuer Wasser und Abfall Nordrhein-  
Westfalen, Dusseldorf (West Germany).  
For primary bibliographic entry see Field 2A.  
W78-07696

**METHODS FOR CALCULATING MAXIMUM  
FLOOD DISCHARGES FOR NATURAL  
WATERCOURSES AND URBAN AREAS IN THE  
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**100-YEAR FLO**  
Flood-Hazar  
Lucerne, L  
California,  
W78-07359

**ABSORPTION**  
Characteriza  
cystis Nidula  
W78-07304

**Hyacinths fo**  
W78-07442

**A Prelimina**  
Algae as Bio  
Pollution in  
W78-07665

**ACETABULAR**  
The Effect o  
vironment o  
Acetabularia  
W78-07213

**ACID-BASE E**  
pH Averagi  
W78-07456

**ACID MINE V**  
Factors Inv  
Trout to Su  
Polluted Wa  
W78-07684

**ACID STREA**  
Nitrification  
Southern N  
W78-07353

**ACTIVATED**  
Ozone in th  
Works,  
W78-07434

**A Pilot Plan**  
Treated Sew  
W78-07445

**Steric Hinc**  
in Activated  
Solution of  
Treated Se  
W78-07455

**Independent**  
Raw Sewage  
W78-07516

**Cross-Flow**  
Treatment  
W78-07533

**Photograph**  
W78-07588

**Adsorption**  
bon Produ  
Industrial  
W78-07599

**European**  
We Can L  
W78-07604

**ACTIVATED**  
Sludge Di  
The Soluti  
W78-07424

**Problems**  
Some Sma  
W78-07427

# SUBJECT INDEX

## 100-YEAR FLOOD STAGE

Flood-Hazard Study--100-Year Flood Stage for  
Lucerne Lake, San Bernardino County,  
California,  
W78-07359 4A

## ABSORPTION

Characterization of Sulphate Uptake in Ana-  
cystis Nidulans,  
W78-07304 5C

Hyacinths for Wastewater Treatment,  
W78-07442 5D

A Preliminary Study of the Use of Benthic  
Algae as Biological Indicators of Heavy Metal  
Pollution in Solfjorden, Norway,  
W78-07665 5A

## ACETABULARIA CRENULATA

The Effect of the Ionic Composition of the En-  
vironment on Oxygen Exchange in the Alga  
Acetabularia (In Russian),  
W78-07213 5C

## ACID-BASE EQUILIBRIUM

pH Averaging,  
W78-07456 5A

## ACID MINE WATER

Factors Involved in the Resistance of Brook  
Trout to Sulfuric Acid Solutions and Mine Acid  
Polluted Waters,  
W78-07684 5C

## ACID STREAMS

Nitrification in Four Acidic Streams in  
Southern New Jersey,  
W78-07353 5C

## ACTIVATED CARBON

Ozone in the Treatment of Odors from Sewage  
Works,  
W78-07434 5D

A Pilot Plant Study on Advanced Treatment of  
Treated Sewage for Re-Use, (In Japanese),  
W78-07445 5D

Steric Hinderance on Competitive Interaction  
in Activated Carbon Adsorption from BI-Solute  
Solution of Phenol and Organics in Biological  
Treated Sewage, (In Japanese),  
W78-07455 5D

Independent Physical-Chemical Treatment of  
Raw Sewage,  
W78-07516 5D

Cross-Flow Filtration in Physical-Chemical  
Treatment of Municipal Sewage Effluents,  
W78-07533 5D

Photographic Processing Effluent Control,  
W78-07588 5D

Adsorption of Textile Dyes by Activated Car-  
bon Produced from Agricultural, Municipal and  
Industrial Wastes,  
W78-07599 5D

European Water Treatment Practices and What  
We Can Learn from Them,  
W78-07604 5F

## ACTIVATED SLUDGE

Sludge Disposal: The Problem, The Search,  
The Solution,  
W78-07424 5D

Problems Encountered in the Up-Grading of  
Some Small Sewage Works,  
W78-07427 5D

## Aeration Plant for Small Communities.

W78-07431 5D

Operational Experience at the Borchers Quar-  
ry Wastewater Treatment Works,  
W78-07433 5D

Heat Treatment and Pressing of Digested  
Sludge,  
W78-07437 5D

Buckland Pollution Control Centre Improves  
Environment in the South West,  
W78-07443 5D

Maximizing Phosphorus Removal in Activated  
Sludge,  
W78-07446 5D

The Production of Protein from Municipal  
Sludge,  
W78-07447 5D

Air vs 02: Two Activated Sludge Systems Com-  
pared,  
W78-07451 5D

The Behavior of F2 Coliphage in Activated  
Sludge Treatment,  
W78-07461 5D

Developments in Performance Relationships  
for Sewage,  
W78-07467 5D

Recycling of Water for Irrigation: Persistence  
of Enteroviruses in Sewage Effluent and Natu-  
ral Waters Receiving the Effluent,  
W78-07471 5B

The Design and Construction of the Martholme  
Regional Sewage-Treatment Works,  
W78-07477 5D

Concepts, Criteria, and Measurements of  
Biodegradability,  
W78-07532 5D

Pollution Control in the Synthetic Resins Indus-  
try,  
W78-07587 5D

Industrial Waste Management in the Dairy In-  
dustry in Poland,  
W78-07590 5D

Dye Waste Treatment and Reuse,  
W78-07600 5D

## ACTIVATED SLUDGE PROCESS

Effect of Time of Deacetylation on Molecular  
Weight Distribution, Acetyl Content, Viscosity,  
and Performance of Chitsan as a Conditioning  
Agent for Activated Sludge,  
W78-07552 5D

## ADENOSINE TRIPHOSPHATE

Anaerobic ATP Levels in the Blue-Green Alga  
Anabaena: Dark-Light Transients and Effects  
of Light Intensity,  
W78-07303 5C

The Relation Between Adenosine Triphosphate  
and Microbial Biomass in Diverse Aquatic  
Ecosystems,  
W78-07306 5C

## ADJUDICATION PROCEDURE

General Adjudication Proceedings,  
W78-07412 6E

## ADJUDICATION PROCEEDINGS

General Adjudication Proceedings,  
W78-07412 6E

## ADMINISTRATIVE AGENCIES

The Role of EPA's Office of Research and  
Development in Irrigated Crop Production  
Research,  
W78-07607 5G

## ADSORPTION

Removal of Chromium Anions from Industrial  
Effluents--By Contacting with Particles of In-  
soluble Lead CPD Adsorbed on Particulate In-  
soluble Carrier.  
W78-07256 5D

Protonation of Organic Bases in Clay-Water  
Systems,  
W78-07364 5B

Steric Hinderance on Competitive Interaction  
in Activated Carbon Adsorption from BI-Solute  
Solution of Phenol and Organics in Biological  
Treated Sewage, (In Japanese),  
W78-07455 5D

## AERATION

Wind Powered Artificial Aeration of Northern  
Prairie Lakes,  
W78-07201 8C

Rotating Disc Sewage Treatment Systems for  
Suburban Developments and High-Density  
Resorts of Hawaii,  
W78-07393 5D

Aeration Plant for Small Communities.  
W78-07431 5D

Operational Experience at the Borchers Quar-  
ry Wastewater Treatment Works,  
W78-07433 5D

Buckland Pollution Control Centre Improves  
Environment in the South West,  
W78-07443 5D

Air vs 02: Two Activated Sludge Systems Com-  
pared,  
W78-07451 5D

Unified Presentation of Weir-Aeration Data,  
W78-07494 2E

Natural Sewage Recycling Systems  
W78-07515 5D

Wastewater Treatment System.  
W78-07580 5D

Kinetic Studies on the Lime Sulfurated Solu-  
tion (Calcium Polysulfide) Process for Removal  
of Heavy Metals from Waste Water,  
W78-07595 5D

Sewage Dewatering Plant for Small Communi-  
ties.  
W78-07660 5D

## AERIAL PHOTOGRAPHY

Land Use and Pollution Patterns on the Great  
Lakes,  
W78-07288 5B

The South Dakota Cooperative Land use Ef-  
fort: A State Level Remote Sensing Demon-  
stration Project,  
W78-07315 4A

The National Land Use Data Program of the  
U.S. Geological Survey,  
W78-07316 4A



# SUBJECT INDEX

## AERIAL PHOTOGRAPHY

Land Use and Environmental Assessment in the Central Atlantic Region, W78-07317 4A

Visual Observations of Floating Ice from Skylab, W78-07346 2C

Floodplain Delineation Using LANDSAT-I Data, W78-07510 4A

## AEROBIC DIGESTOR PERFORMANCE

New Procedure Determines Aerobic Sludge Stability, W78-07464 5D

## AEROBIC TREATMENT

Aeration Plant for Small Communities, W78-07431 5D

## AEROSOLS

The Role of Surface Microlayer of Water in the Distribution and Fate of Trace Organic Contaminants; A Feasibility Study, W78-07319 5B

## AESTHETICS

An Attempt to Quantify the Esthetics of Wild and Scenic Rivers in Idaho, W78-07220 6B

## AGRICULTURAL ECONOMICS

Economic and Agronomic Effects of High Irrigation Levels on Alfalfa and Barley, W78-07397 3F

## AGRICULTURE

The '208' Planning Effort for Irrigated Agriculture in the State of Washington, W78-07642 5G

## AGRONOMIC CROPS

Economic and Agronomic Effects of High Irrigation Levels on Alfalfa and Barley, W78-07397 3F

## AIR POLLUTION

The Role of Surface Microlayer of Water in the Distribution and Fate of Trace Organic Contaminants; A Feasibility Study, W78-07319 5B

Arrestment of Fumes in the Non-Ferrous Metals Industry, W78-07596 5G

## AIRCRAFT

The South Dakota Cooperative Land use Effort: A State Level Remote Sensing Demonstration Project, W78-07315 4A

The National Land Use Data Program of the U.S. Geological Survey, W78-07316 4A

Land Use and Environmental Assessment in the Central Atlantic Region, W78-07317 4A

## ALASKA

Environmental Assessment of the Alaskan Continental Shelf. Annual Reports Summary for the Year Ending March 1977, W78-07557 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter April - June 1977, W78-07558 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter April - June 1977, W78-07559 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter July - September 1977, W78-07560 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter July - September 1977, W78-07561 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume III. Principal Investigators' Reports for the Quarter July - September 1977, W78-07562 6G

## ALDRIN

Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W78-07661 5C

A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem, W78-07667 5A

## ALGAE

Photorespiration in Larger Littoral Algae, W78-07274 5C

Morphological Investigations of Asymmetry in Desmids, W78-07284 2I

Eulimnion, an Original Place of New Forms, W78-07285 5C

Photorespiration in Marine Phytoplankton, W78-07309 5C

Summary Report - The Chowan River Project, W78-07318 5C

Ecological Components Structuring the Seaward Edges of Tropical Pacific Reefs: The Distribution, Communities and Productivity of Porolithon, W78-07327 2L

Plant Species Diversity in a Marine Intertidal Community: Importance of Herbivore Food Preference and Algal Competitive Abilities, W78-07341 2L

A Preliminary Study of the Use of Benthic Algae as Biological Indicators of Heavy Metal Pollution in Sørkjorden, Norway, W78-07665 5A

## ALGAL CONTROL

Make Wastewater More Versatile: Reuse it for Recreation Lakes, W78-07217 5D

Nuisance-Algae Control Through Mechanical Harvesting, W78-07266 5G

Physical-Chemical Methods for the Control of Algal Species and Composition in Algal Culturing Facilities, W78-07324 5G

## ALGAL GROWTH

Summary Report - The Chowan River Project, W78-07318 5C

## ALGORITHMS

Capacity Planning for Regional Wastewater Treatment Systems, W78-07521 5D

## ALLIGATORWEED

Water Hyacinths and Alligator Weeds for Final Filtration of Sewage, W78-07299 5D

## ALLOTMENTS

General Adjudication Proceedings, W78-07412 6E

## ALLUVIAL CHANNELS

Scour and Fill in Steep, Sand-Bed Ephemeral Streams, W78-07379 2I

## ALTERNATIVE ENERGY SOURCES

Identification of Alternative Power Sources for Dredged Material Processing Operations, W78-07680 8C

## ALTERNATIVE PLANNING

Nonstructural Floodplain Planning, W78-07221 6F

## ALUM

Independent Physical-Chemical Treatment of Raw Sewage, W78-07516 5D

## ALUMINUM

Cross-Flow Filtration in Physical-Chemical Treatment of Municipal Sewage Effluents, W78-07533 5D

## AMERICAN FALLS RESERVOIR (ID)

A Generalized Water Quality Model for Eutrophic Lakes and Reservoirs, W78-07290 5C

## AMERICAN SHAD

Management of the Northern Chesapeake Bay American Shad Fishery, W78-07337 6B

## AMINO ACIDS

Stable Nitrogen-Containing Dissolved Organic Substance in Lake Schoohsee and in Cultures of Algae (In German), W78-07260 5B

The Production of Protein from Municipal Sludge, W78-07447 5D

## AMMONIA

Studies on the Toxicity of Ammonia, Nitrate and their Mixtures to Guppy Fry, W78-07214 5C

Nitrification and Nitrogen Removal, W78-07215 5D

Rate of Ammonium Nitrification and Nitrate Leaching in Soil Columns, W78-07520 5B

Nutrient Distributions and Transport in Long Island Sound, W78-07550 5B

## AMMONIUM COMPOUNDS

Clinoptilolite Column Ammonia Removal Model, W78-07466 5D

# SUBJECT INDEX

## ARKANSAS RIVER

- ANABAENA VARIABILIS**  
Anaerobic ATP Levels in the Blue-Green Alga  
Anabaena: Dark-Light Transients and Effects  
of Light Intensity,  
W78-07303 5C
- ANACYSTIS NIDULANS**  
Characterization of Sulphate Uptake in Ana-  
cystis Nidulans,  
W78-07304 5C
- ANAEROBIC CONDITIONS**  
Sludge Disposal: The Problem, The Search,  
The Solution,  
W78-07424 5D
- Treatment and Use of Sewage Purification  
Plant Sludges,  
W78-07425 5D
- ANAEROBIC DIGESTION**  
Performance of a Trickling Filter, Solids  
Removal, and Anaerobic Digestion System for  
Recycled Poultry Manure Wastewater,  
W78-07207 5D
- Conserve Energy in Wastewater Systems,  
W78-07476 5D
- Solubilization of Organic Carbon During the  
Acid Phase of Anaerobic Digestion,  
W78-07518 5D
- ANALOG COMPUTERS**  
Vortex-Shedding Flowmeters,  
W78-07459 7B
- ANALYTICAL TECHNIQUES**  
A New Dialysis-Ion Exchange Technique for  
Determining the Forms of Trace Metals in  
Water,  
W78-07277 5A
- A Study of Different Analytical Extraction  
Methods for Nondetril Heavy Metals in  
Aquatic Sediments,  
W78-07278 5A
- Determination of Total Organic Carbon in Pot-  
able Water, Sewage, Industrial Effluents, and  
Boiler Feed Water,  
W78-07404 5A
- Steric Hinderance on Competitive Interaction  
in Activated Carbon Adsorption from BI-Solute  
Solution of Phenol and Organics in Biological  
Treated Sewage, (In Japanese),  
W78-07455 5D
- Measuring Petroleum Hydrocarbons in  
Digested Sewage Sludges,  
W78-07462 5A
- New Procedure Determines Aerobic Sludge  
Stability,  
W78-07464 5D
- Climnitolite Column Ammonia Removal  
Model,  
W78-07466 5D
- Developments in Performance Relationships  
for Sewage,  
W78-07467 5D
- Sampling of Water and Wastewater,  
W78-07517 5A
- Virion Aggregation and Disinfection of Water  
Viruses by Bromine,  
W78-07524 5F
- Concepts, Criteria, and Measurements of  
Biodegradability,  
W78-07532 5D
- A Test and a Technique for Predicting BOD5  
Values of Kraft Mill Waste,  
W78-07597 5A
- ANIMAL METABOLISM**  
A Comparative Study of the Effects of Mercu-  
ric Chloride and Methyl Mercury Chloride on  
Reproductive Performance in the Brine  
Shrimp, Artemia Salina,  
W78-07668 5C
- APPARATUS**  
Nuisance-Algae Control Through Mechanical  
Harvesting,  
W78-07266 5G
- APPLICATION EQUIPMENT**  
Traveling Sprinkler Guide Wheel Assembly,  
W78-07244 3F
- APPROPRIATION**  
Administrative Practice and Procedure Under  
Permit Systems,  
W78-07411 6E
- Practical Aspects of Water Litigation,  
W78-07413 6E
- AQUATIC BACTERIA**  
Monitoring of Waters for Bdellovibrio Bac-  
teriovorus - A Parasite of Gram Negative En-  
teric Bacteria Present in Sewage,  
W78-07323 5A
- AQUATIC FUNGI**  
Sewage Fungus Growth in Rivers Receiving  
Paper Mill Effluent,  
W78-07655 5C
- AQUATIC LIFE**  
Environmental Assessment of the Alaskan  
Continental Shelf. Volume I. Principal In-  
vestigators' Reports for the Quarter April -  
June 1977,  
W78-07558 6G
- AQUATIC PLANT CONTROL**  
Distribution, Growth, and Phosphorus Rela-  
tionships of Myriophyllum Heterophyllum  
Michx. in Lake Winnepesaukee, New  
Hampshire,  
W78-07482 5C
- AQUATIC PLANTS**  
Role of Higher Aquatic Vegetation in the Accu-  
mulation of Organic and Biogenic Substances  
in Inland Waters,  
W78-07294 5C
- AQUATIC VASCULAR PLANTS**  
Distribution, Growth, and Phosphorus Rela-  
tionships of Myriophyllum Heterophyllum  
Michx. in Lake Winnepesaukee, New  
Hampshire,  
W78-07482 5C
- AQUATIC WEED CONTROL**  
Benthic Semi-Barrier to Control the Growth of  
Weeds in Aquatic Environments,  
W78-07257 5G
- Production of Monosex White Amur for  
Aquatic Plant Control,  
W78-07326 4A
- Aquatic Use Pattern for Diquat for Control of  
Egeria and Hydrilla,  
W78-07399 5G
- Efficacy and Residues of Diquat Applied for  
Control of Egeria and Hydrilla,  
W78-07400 5G
- Greenhouse Studies of the Growth and  
Reproduction of Egeria Densa,  
W78-07401 4A
- Aquatic Weed Control in Small Reservoirs with  
Diquat,  
W78-07402 5G
- Final Environmental Statement for Walker  
Dam Impoundment, Aquatic Plant Control Pro-  
ject, New Kent County, Virginia,  
W78-07403 6G
- AQUATIC WEEDS**  
Benthic Semi-Barrier to Control the Growth of  
Weeds in Aquatic Environments,  
W78-07257 5G
- AQUICULTURE**  
Physical-Chemical Methods for the Control of  
Algal Species and Composition in Algal Cultur-  
ing Facilities,  
W78-07324 5G
- AQUIFER CHARACTERISTICS**  
Preliminary Digital Model of the Arikaree  
Aquifer in the Sweetwater River Basin, Central  
Wyoming,  
W78-07351 2F
- Water-Level Changes in Wells Along the West  
Side of the Cedar Creek Anticline, Southeast-  
ern Montana,  
W78-07357 4B
- Description of Wells at Beale Air Force Base  
and Vicinity, California,  
W78-07358 4B
- AQUIFERS**  
Uranium-Isotope Variations in Groundwaters  
of the Floridan Aquifer and Boulder Zone of  
South Florida,  
W78-07343 5B
- AREAL**  
Areal Predictions of Soil Water Flux in the Un-  
saturated Zone,  
W78-07630 2G
- ARIZONA**  
Minimizing Salt in Return Flow by Improving  
Irrigation Efficiency,  
W78-07616 5G
- An Assessment of Irrigation Efficiencies and  
Drainage Return Flows from the Wellton-  
Mohawk Division of the Gila Project,  
W78-07644 3C
- Wellton-Mohawk On-Farm Systems Improve-  
ment Program,  
W78-07645 3C
- ARKANSAS**  
Water Resources Data for Arkansas, Water  
Year 1976,  
W78-07314 7C
- Report of the Annual Yield of the Arkansas  
River Basin for the Arkansas River Basin Com-  
pact, Arkansas--Oklahoma, 1977 Water Year,  
W78-07345 4A
- ARKANSAS RIVER**  
Radionuclide Concentrations in the Arkansas  
River Upstream and Downstream from the  
Nuclear 1 Power Generating Facility,  
W78-07320 5B

# SUBJECT INDEX

## ARKANSAS RIVER

### ARKANSAS RIVER BASIN

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1977 Water Year, W78-07345 4A

### AROCHELORES

Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W78-07661 5C

### AROMATIC COMPOUNDS

Sedimentary Record of Heavy Metals and Polycyclic Aromatic Hydrocarbons in Lake Constance (In German), W78-07307 5B

### ARTESIAN AQUIFERS

Flow to a Nonpenetrating Well in a Leaky Artesian Aquifer with Variable Discharge, W78-07378 2F

### ARTIFICIAL AERATION

Wind Powered Artificial Aeration of Northern Prairie Lakes, W78-07201 8C

### ARTIFICIAL RECHARGE

Artificial Ground-Water Recharge with Capillarity, W78-07365 4B

Natural Sewage Recycling Systems W78-07515 5D

Reuse of Municipal Wastewater for Ground-water Recharge, W78-07570 5D

### ASCE (CONFERENCES)

First Four Decades of the Hydraulics Division, W78-07382 2A

### ASCE (TECHNICAL DIVISIONS)

First Four Decades of the Hydraulics Division, W78-07382 2A

### ASYMMETRY

Morphological Investigations of Asymmetry in Desmids, W78-07284 2I

### ATRAZINE

Analysis of Various Iowa Waters for Selected Pesticides: Atrazine, DDE, and Dieldrin--1974, W78-07331 5A

### AUSTRALIA

Urban Hydrological Modeling and Catchment Research in Australia, W78-07699 2A

### AUTOMATION

Instrumentation and Automation in Water and Wastewater Treatment, W78-07525 5A

### AVALANCHES

Investigation of Snow Control Systems on an Avalanche Slope, W78-07375 4A

### BACTERIA

Preliminary Tests of the Influence of Waste Waters from Sugar Factories on the Numbers of Intestinal Bacteria in Water (In German), W78-07223 5C

Stable Nitrogen-Containing Dissolved Organic Substance in Lake Schochsee and in Cultures of Algae (In German), W78-07260 5B

The Utilization of Dissolved Organic Compounds in Aquatic Environments, W78-07296 5C

Nutrient, Bacterial, and Virus Control as Related to Ground Water Contamination, W78-07571 5B

Mutant Bacteria Solve BOD Problem at Heat Packing Plant, W78-07603 5D

Microbial Interactions with Pesticides in Estuarine Surface Slicks, W78-07605 5C

### BACTERIOPHAGE

The Behavior of F2 Coliphage in Activated Sludge Treatment, W78-07461 5D

### BAFFLES

Model Tests of Circular Sewage Sedimentation Tanks, W78-07468 5D

Drag on Baffle Walls in Hydraulic Jump, W78-07491 8B

### BALTIC SEA COAST (POLAND)

Investigation of Oil Pollution on the Polish Baltic Coast in 1974/1975 (In Polish), W78-07265 5B

### BANDON AREA (OR)

An Engineering Report on Selected Reservoir Sites in the Bandon Area, W78-07280 6B

### BARRIER ISLANDS

Physical, Chemical, and Biological Characteristics of Nearshore Zone of Sand Key, Florida, Prior to Beach Restoration. Vol. 1, W78-07407 2J

### BASELINE STUDIES

Freshwater Resources of the Oregon Coastal Zones, W78-07281 2L

Physical, Chemical, and Biological Characteristics of Nearshore Zone of Sand Key, Florida, Prior to Beach Restoration. Vol. 1, W78-07407 2J

Nearshore Fish and Macroinvertebrate Assemblages Along the Strait of Juan de Fuca Including Food Habits of Nearshore Fish, W78-07543 2L

Surface Drifter Movements Observed in Outer Strait of Juan de Fuca, July 1977, W78-07545 5B

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter April - June 1977, W78-07558 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter April - June 1977, W78-07559 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter July - September 1977, W78-07560 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter July - September 1977, W78-07561 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume III. Principal Investigators' Reports for the Quarter July - September 1977, W78-07562 6G

### BATHYMETRIC SURVEYS

The 1973 Bathymetric Survey in the New York Bight Apex: Maps and Geological Implications, W78-07548 2L

### BAYOU TEXAR (FLA)

Water-Column and Benthic Invertebrate and Plant Associations as Affected by the Physico-Chemical Aspects in a Mesotrophic Bayou Estuary Pensacola, Florida, W78-07203 5C

### BDELLOVIBRIO

Monitoring of Waters for Bdellovibrio Bacteriovorus - A Parasite of Gram Negative Enteric Bacteria Present in Sewage, W78-07323 5A

### BDELLOVIBRIO-BACTERIOVORUS

The Effect of Chemicals on Some Microbial Self-Purification Processes in Bodies of Water (In Russian), W78-07298 5C

### BEACH EROSION

Physical, Chemical, and Biological Characteristics of Nearshore Zone of Sand Key, Florida, Prior to Beach Restoration. Vol. 1, W78-07407 2J

### BEALE AIR FORCE BASE (CALIF)

Description of Wells at Beale Air Force Base and Vicinity, California, W78-07358 4B

### BED LOAD

Sedimentation of River Navigation Channels, W78-07486 2I

### BENTHIC FAUNA

Macrobenthos of the Tidal Delaware River Between Trenton and Burlington, New Jersey, W78-07300 5C

Marine Waste Disposal in the New York Bight--Public Policy, Environmental Impacts, and Alternative Futures, W78-07529 5E

Patterns of Succession in Benthic Infaunal Communities Following Dredging and Dredged Material Disposal in Monterey Bay, W78-07677 5C

### BENTHIC FLORA

A Preliminary Study of the Use of Benthic Algae as Biological Indicators of Heavy Metal Pollution in Solfjorden, Norway, W78-07665 5A

### BENTHOS

An In Situ Study of Recruitment, Growth and Survival of Subtidal Marine Algae: Techniques and Preliminary Results, W78-07308 5C

### BEST MANAGEMENT PRACTICES

Development of Best Management Practices for Salinity Control in Grand Valley, W78-07650 5G

## BIBLIOGRAPHY

Nitrification W78-07215

Tidal Marsh Index (Partial) W78-07226

History of So W78-07417

## HIG THOMPSON

Flooding in Tributaries: Estimates of W78-07371

## HOASSAY

Studies on and their M W78-07214

## HIOCHEMICAL

Landmark not Worth t W78-07475

## NIGHT SOIL

Kawamuko (Denipakku) sue shi kaw W78-07478

## CONCEPTS,

Biodegradation W78-07532

## INDUSTRIAL V

dustry in Po W78-07590

## A TEST AND

Values of K W78-07597

## BIOLOGICAL

W78-07656

## NOCONTR

Use of Z Catfish Pro W78-07292

## PRODUCTION

Aquatic Ph W78-07326

## NODEGRAD

Effect of T and Dewat W78-07457

## POLISH/U.S.

ment and S W78-07530

## CONCEPTS,

Biodegrad W78-07532

## NOGENIC S

Role of H simulation in Inland V W78-07294

## NOGEOGR

Northumb ry, W78-07311



# SUBJECT INDEX

## BRINE SHRIMP

### BIBLIOGRAPHIES

- Nitrification and Nitrogen Removal,  
W78-07215 5D
- Tidal Marsh Bibliography, Selected Key Work  
Index (Partially Annotated),  
W78-07226 2L
- History of Sewage Pumping in Britain,  
W78-07417 8C

### BIG THOMPSON RIVER (COLO)

- Flooding in Big Thompson River, Colorado,  
Tributaries: Controls on Channel Erosion and  
Estimates of Recurrence Interval,  
W78-07371 4D

### BIOMASS

- Studies on the Toxicity of Ammonia, Nitrate  
and their Mixtures to Guppy Fry,  
W78-07214 5C

### BIOCHEMICAL OXYGEN DEMAND

- Landmark Texas Decision Agrees Benefit is  
Not Worth the Cost,  
W78-07475 5G

- Night Soil Treatment by 'Denipac Process'-  
Kawamuko Treatment Plant, Matsue City (2),  
(Denipakku puroseshi ni yoru shinyo shori-mat-  
sue shi kawamuko shorijo),  
W78-07478 5D

- Concepts, Criteria, and Measurements of  
Biodegradability,  
W78-07532 5D

- Industrial Waste Management in the Dairy In-  
dustry in Poland,  
W78-07590 5D

- A Test and a Technique for Predicting BOD5  
Values of Kraft Mill Waste,  
W78-07597 5A

- Biological Wastewater System.  
W78-07656 5D

### BIOCONTROL

- Use of Zooplanktophagic Fishes in Channel  
Catfish Production Ponds,  
W78-07292 5C

- Production of Monosex White Amur for  
Aquatic Plant Control,  
W78-07326 4A

### BIODEGRADATION

- Effect of Thermal Pretreatment on Digestibility  
and Dewaterability of Organic Sludges,  
W78-07457 5D

- Polish/U.S. Symposium on Wastewater Treat-  
ment and Sludge Disposal: Volume II.  
W78-07530 5D

- Concepts, Criteria, and Measurements of  
Biodegradability,  
W78-07532 5D

### BIOGENIC SUBSTANCES

- Role of Higher Aquatic Vegetation in the Accu-  
mulation of Organic and Biogenic Substances  
in Inland Waters,  
W78-07294 5C

### BIOGEOGRAPHY

- Northumberland County Tidal Marsh Invento-  
ry,  
W78-07311 2L

### BIOINDICATORS

- Missouri River Basin Sterol Assay Project Re-  
port. Coprostanol, A Positive Marker of  
Domestic and Run-Off Pollution: Sterol Assay  
of Wastewater Plant Effluents and Surface  
Waters of the Lower Main Stem Missouri,  
W78-07328 5A

- Mississippi River Basin Sterol Assay Project  
Report. Coprostanol, A Positive Molecular  
Marker of Domestic and Run-Off Sewage,  
Wastewater Plant Effluent and Surface Waters  
in the Burlington, Iowa Area on the Mississippi  
River,  
W78-07329 5A

- New Procedure Determines Aerobic Sludge  
Stability,  
W78-07464 5D

- Travel of Microorganisms from a Septic Tile,  
W78-07469 5B

- A Preliminary Study of the Use of Benthic  
Algae as Biological Indicators of Heavy Metal  
Pollution in Sørkjorden, Norway,  
W78-07665 5A

### BIOLOGICAL COMMUNITIES

- Ecological Components Structuring the  
Seaward Edges of Tropical Pacific Reefs: The  
Distribution, Communities and Productivity of  
Porolithon,  
W78-07327 2L

### BIOLOGICAL MEMBRANES

- Trace Metal-Chelator Interactions and  
Phytoplankton Growth in Seawater Media:  
Theoretical Analysis and Comparison with Re-  
ported Observations,  
W78-07663 5C

- Copper Sensitivity of Gonyaulax Tamarensis,  
W78-07664 5C

### BIOLOGICAL TREATMENT

- Sewage Purification System,  
W78-07250 5D

- Water Purifying Device Without Movable  
Mechanical Part in Contact with the Liquid to  
be Treated,  
W78-07252 5D

- Biologically Purifying Waste Water in Air  
Tank--Using Extract of Excess Active Slime as  
Biostimulator.  
W78-07255 5D

- Background Ecology and the Effects of  
Nutrient Additions on a Central Michigan Wet-  
land,  
W78-07279 5C

- Water Hyacinths and Alligator Weeds for Final  
Filtration of Sewage,  
W78-07299 5D

- Data Report--Marsh/Pond System,  
W78-07338 5D

- Rotating Disc Sewage Treatment Systems for  
Suburban Developments and High-Density  
Resorts of Hawaii,  
W78-07393 5D

- Hoscar's Extension Should Deodorize the  
Douglas,  
W78-07418 5D

- A Pilot Plant Study on Advanced Treatment of  
Treated Sewage for Re-Use, (In Japanese),  
W78-07445 5D

- Maximizing Phosphorus Removal in Activated  
Sludge,  
W78-07446 5D

- The Behavior of F2 Coliphage in Activated  
Sludge Treatment,  
W78-07461 5D

- Concepts, Criteria, and Measurements of  
Biodegradability,  
W78-07532 5D

- Mutant Bacteria Solve BOD Problem at Heat  
Packing Plant,  
W78-07603 5D

- Biological Wastewater System.  
W78-07656 5D

### BIOMASS

- The Relation Between Adenosine Triphosphate  
and Microbial Biomass in Diverse Aquatic  
Ecosystems,  
W78-07306 5C

### BIOTA

- An Analytical Evaluation of the Utilization and  
Management of Water Resources in the Lake  
Metigoshe Watershed, North Dakota,  
W78-07209 5C

### BIRTH RATE

- Method of Average Birth and Death Rate  
Evaluation in the Marine-Terrestrial Bacteria  
Interactions,  
W78-07263 5C

- IBM 1130 Computation Process in the Study of  
Biophysical Constants Variations of  
Pathogenous Bacteria by Phytoplankton,  
W78-07264 5C

### BODIES OF WATER

- Investigation of Level Fluctuations in Closed  
Bodies of Water on the Basis of Stochastic  
Models of the Elements of the Hydrologic  
Budget,  
W78-07500 2E

### BOILING

- Chrome Dyeing of Wool: Reducing the Amount  
of Chromium in the Residual Bath,  
W78-07601 5D

### BOREHOLES

- Boring Machines Pick Up Speed on Deep  
Chicago Sewer Tunnels.  
W78-07423 8C

### BOUNDARIES (PROPERTY)

- Delineation of Tidal Wetlands Boundaries in  
Lower Chesapeake Bay and its Tributaries,  
W78-07229 2L

### BOUNDARIES (SURFACES)

- Theory and Numerical Analysis of Moving  
Boundary Problems in the Hydrodynamics of  
Porous Media,  
W78-07389 2F

### BREAM

- A Five-Year Monitoring Study of the  
Chlorinated Hydrocarbons in the Fish of a Fin-  
nish Lake Ecosystem,  
W78-07667 5A

### BRINE SHRIMP

- A Comparative Study of the Effects of Mercu-  
ric Chloride and Methyl Mercury Chloride on  
Reproductive Performance in the Brine  
Shrimp, Artemia Salina,  
W78-07668 5C

# SUBJECT INDEX

## BRINE SHRIMP

### BRITISH COLUMBIA

Variation of Drainage Density in a Small British Columbia Watershed, W78-07505 4D

### BROMIDES

Groundwater Tracing with Post Sampling Activation Analysis Using Bromide and Iodide Ions Injected Simultaneously into a Shallow-Well System, W78-07683 5B

### BROMINE

Virion Aggregation and Disinfection of Water Viruses by Bromine, W78-07524 5F

### BROOK TROUT

Factors Involved in the Resistance of Brook Trout to Sulfuric Acid Solutions and Mine Acid Polluted Waters, W78-07684 5C

### BUENA VISTA MARSH (WISC)

Effects of Stream Channelization on Terrestrial Wildlife and Their Habitats in the Buena Vista Marsh, Wisconsin, W78-07228 6G

### BURLINGTON (IA)

Mississippi River Basin Sterol Assay Project Report. Coprostanol, A Positive Molecular Marker of Domestic and Run-Off Sewage, Wastewater Plant Effluent and Surface Waters in the Burlington, Iowa Area on the Mississippi River, W78-07329 5A

### CADMIUM

Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, *Palaeomonetes pugio*: Importance of Free Cadmium Ion, W78-07662 5C

A Preliminary Study of the Use of Benthic Algae as Biological Indicators of Heavy Metal Pollution in Sørforjorden, Norway, W78-07665 5A

### CALCIUM HYPOCHLORITE

Detoxification of Staphylococcal-Enterotoxin B in Water (In German), W78-07232 5F

### CALIFORNIA

Description of Wells at Beale Air Force Base and Vicinity, California, W78-07358 4B

Flood-Hazard Study--100-Year Flood Stage for Lucerne Lake, San Bernardino County, California, W78-07359 4A

Scour and Fill in Steep, Sand-Bed Ephemeral Streams, W78-07379 2J

Economic Impact of Water Quality on River Basin Management, W78-07396 5G

Surface Currents as Determined by Drift Card Releases Over the Continental Shelf Off Central and Southern California, W78-07556 5B

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Executive Summary), W78-07564 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Final Report), W78-07565 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Case Studies), W78-07566 6G

Variability of Nitrate Leaching Within Defined Management Units, W78-07612 5B

Evaluation of Surface Irrigation Return Flows in the Central Valley of California, W78-07624 5B

An Economic Analysis of Irrigation Return Flow Recycle Systems in the Central Valley of California, W78-07625 5G

Agricultural Drainage Problems of the San Joaquin Valley, W78-07636 4A

How the NPDES Program Will Define Present Water Quality Conditions, W78-07637 5G

A Valleywide Solution--The Interagency Drainage Program, W78-07639 4A

### CALIFORNIA CURRENT

Annual Fluctuations in Biomass of Taxonomic Groups of Zooplankton in the California Current, W78-07275 5C

### CANADA

A Simple Model for Cross-Shelf Mixing on the Scotian Shelf, W78-07366 2L

Generation of Ungaged Streamflow Data, W78-07384 2A

Hydrological Studies on a Small Basin on the Canadian Shield, W78-07406 2H

Variation of Drainage Density in a Small British Columbia Watershed, W78-07505 4D

### CANAL SEEPAGE

Seepage Study of the Sevier Valley-Piute Canal, Sevier County, Utah, W78-07360 4A

### CAPILLARY ACTION

Artificial Ground-Water Recharge with Capillarity, W78-07365 4B

### CAPILLARY FLOW

Artificial Ground-Water Recharge with Capillarity, W78-07365 4B

### CAPILLARY ZONE

Artificial Ground-Water Recharge with Capillarity, W78-07365 4B

### CAPITAL COSTS

National Needs for Combined Sewer Overflow Control, W78-07422 5D

### CARBOHYDRATES

Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent, W78-07655 5C

### CARBON

The Impact of Nitrogen and Phosphorus Release from a Siliceous Sediment on the Overlying Water, W78-07302 5C

The Relation Between Adenosine Triphosphate and Microbial Biomass in Diverse Aquatic Ecosystems, W78-07306 5C

Determination of Total Organic Carbon in Potable Water, Sewage, Industrial Effluents, and Boiler Feed Water, W78-07404 5A

Solubilization of Organic Carbon During the Acid Phase of Anaerobic Digestion, W78-07518 5D

### CARBON DIOXIDE

Kinetic Studies on the Lime Sulfurated Solution (Calcium Polysulfide) Process for Removal of Heavy Metals from Waste Water, W78-07595 5D

### CASPIAN SEA

Investigation of Level Fluctuations in Closed Bodies of Water on the Basis of Stochastic Models of the Elements of the Hydrologic Budget, W78-07500 2F

### CEDAR CREEK ANTICLINE

Water-Level Changes in Wells Along the West Side of the Cedar Creek Anticline, Southeastern Montana, W78-07357 4B

### CELLULOSE

Biologically Purifying Waste Water in Air Tank--Using Extract of Excess Active Slime as Biostimulator, W78-07255 5D

Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent, W78-07655 5C

### CENSUS

City of Newport News and Fort Eustis Tidal Marsh Inventory, W78-07224 2L

Inventory of Lake Ontario Inlets and Harbors: Niagara River to Stony Creek, W78-07225 2H

York County and Town of Poquoson Tidal Marsh Inventory, W78-07310 2L

Northumberland County Tidal Marsh Inventory, W78-07311 2L

### CENTRAL ATLANTIC STATES

Land Use and Environmental Assessment in the Central Atlantic Region, W78-07317 4A

### CENTRAL VALLEY (CALIF)

Evaluation of Surface Irrigation Return Flows in the Central Valley of California, W78-07624 5B

# SUBJECT INDEX

## CHLOROPHYLL

- An Economic Analysis of Irrigation Return Flow Recycle Systems in the Central Valley of California, W78-07625 5G
- CENTRAL YAKUTIA (USSR)**  
 Temperature Regime of Low-Head Earth Dams in Central Yakutia, W78-07512 8D
- CENTRIFUGAL PUMPS**  
 History of Sewage Pumping in Britain, W78-07417 8C  
 The Thickening and Centrifuging of Sludge, W78-07436 5D
- CENTRIFUGATION**  
 The Thickening and Centrifuging of Sludge, W78-07436 5D  
 The Production of Protein from Municipal Sludge, W78-07447 5D  
 Starch-Laden Effluent Treatment-A Case History, W78-07591 5D
- CHANNEL CATFISH**  
 Use of Zooplanktonphagic Fishes in Channel Catfish Production Ponds, W78-07292 5C
- CHANNEL EROSION**  
 Flooding in Big Thompson River, Colorado, Tributaries: Controls on Channel Erosion and Estimates of Recurrence Interval, W78-07371 4D
- CHANNEL FLOW**  
 Variation of Drainage Density in a Small British Columbia Watershed, W78-07505 4D
- CHANNEL IMPROVEMENT**  
 Improvements for Little River Inlet, South Carolina; Hydraulic Model Investigation, W78-07671 8B
- CHANNELING**  
 Effects of Stream Channelization on Terrestrial Wildlife and Their Habitats in the Buena Vista Marsh, Wisconsin, W78-07228 6G
- CHANNELS**  
 Sedimentation of River Navigation Channels, W78-07486 2J
- CHATAHOOCHEE RIVER (GA)**  
 West Point Lake Postimpoundment Study, W78-07287 5C
- CHELATION**  
 Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes Pugio: Importance of Free Cadmium Ion, W78-07662 5C  
 Trace Metal-Ohelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations, W78-07663 5C  
 Copper Sensitivity of Gonyaulax Tamarensis, W78-07664 5C
- CHEMCONTROL**  
 Greenhouse Studies of the Growth and Reproduction of Egeria Densa, W78-07401 4A
- CHEMICAL GROUTING**  
 Grouting Provides Economical and Effective Maintenance in Kansas, W78-07421 8G
- CHEMICAL OXYGEN DEMAND**  
 Solubilization of Organic Carbon During the Acid Phase of Anaerobic Digestion, W78-07518 5D
- CHEMICAL PRECIPITATION**  
 Suggested Method for Vanadate Removal from Mill Effluents, W78-07332 5D  
 Maximizing Phosphorus Removal in Activated Sludge, W78-07446 5D  
 Nitrification Systems with Integrated Phosphorus Precipitation, W78-07450 5D  
 Phosphorus Removal by Precipitation with FE (III), W78-07465 5D  
 Process Design Manual for Phosphorus Removal, W78-07527 5D  
 Kinetic Studies on the Lime Sulfurated Solution (Calcium Polysulfide) Process for Removal of Heavy Metals from Waste Water, W78-07595 5D
- CHEMICAL REACTIONS**  
 Trace Metal-Ohelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations, W78-07663 5C
- CHEMICAL SPECIATION**  
 Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes Pugio: Importance of Free Cadmium Ion, W78-07662 5C
- CHEMICAL TREATMENT**  
 Cross-Flow Filtration in Physical-Chemical Treatment of Municipal Sewage Effluents, W78-07533 5D
- CHEMICAL WASTES**  
 The Effect of Chemicals on Some Microbial Self-Purification Processes in Bodies of Water (In Russian), W78-07298 5C  
 Implementing Cost-Effective Pollution Control by Means of Effluent Charges: An Example Applied to Electroplating Discharges, W78-07481 5G  
 Preservation of Phenolic Compounds in Wastewaters, W78-07586 5D  
 Pollution Control in the Synthetic Resins Industry, W78-07587 5D  
 Photographic Processing Effluent Control, W78-07588 5D  
 Ozonation of Coal Gasification Plant Wastewater, W78-07589 5A
- CHESAPEAKE BAY**  
 Delineation of Tidal Wetlands Boundaries in Lower Chesapeake Bay and its Tributaries, W78-07229 2L
- Management of the Northern Chesapeake Bay American Shad Fishery, W78-07337 6B
- CHICKAHOMINY RESERVOIR (VA)**  
 Final Environmental Statement for Walker Dam Impoundment, Aquatic Plant Control Project, New Kent County, Virginia, W78-07403 6G
- CHITOSAN**  
 Effect of Time of Deacetylation on Molecular Weight Distribution, Acetyl Content, Viscosity, and Performance of Chitsan as a Conditioning Agent for Activated Sludge, W78-07552 5D
- CHLORELLA**  
 Biological Purification of Sugar Works Waste Water-Includes Neutralization with Lime and Inoculation with Chlorella Culture Using Light and Carbon Dioxide, W78-07259 5D
- CHLORIDES**  
 Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes Pugio: Importance of Free Cadmium Ion, W78-07662 5C
- CHLORINATED HYDROCARBON PESTICIDES**  
 The Relationship of Lake Quality to Specific Urbanization Stresses, W78-07204 5C  
 Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W78-07661 5C  
 A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem, W78-07667 5A
- CHLORINATION**  
 The Dangers of Inadequate Chlorination of Polluted Waters, W78-07435 5D  
 Recent Advances in Ozone Technology, W78-07444 5D  
 Chlorine Detector Saves a Life, W78-07453 5A  
 Recycling of Water for Irrigation: Persistence of Enteroviruses in Sewage Effluent and Natural Waters Receiving the Effluent, W78-07471 5B  
 Cottage Farm Combined Sewer Detection and Chlorination Station, Cambridge, Massachusetts, W78-07534 5D
- CHLORINE**  
 Chlorine Detector Saves a Life, W78-07453 5A
- CHLOROPHENYL-DIMETHYLUREA**  
 Anaerobic ATP Levels in the Blue-Green Alga Anabaena: Dark-Light Transients and Effects of Light Intensity, W78-07303 5C
- CHLOROPHYLL**  
 Nitrogen Transformations in Land Treatment, W78-07216 5B



# SUBJECT INDEX

## CHLOROPLASTS

### CHLOROPLASTS

Evolutionary Studies on the Shape of the Cell and of the Chloroplast in Desmids, W78-07283 2I

### CHOWAN RIVER ESTUARY (NC)

Summary Report - The Chowan River Project, W78-07318 5C

### CHRISTCHURCH (NEW ZEALAND)

Hydrogeology of Metropolitan Christchurch, W78-07368 4B

### CHROMIUM

Removal of Chromium Anions from Industrial Effluents--By Contacting with Particles of Insoluble Lead CPD Adsorbed on Particulate Insoluble Carrier, W78-07256 5D

Plater Meets 'New Source' Requirements, W78-07593 5D

Chrome Dyeing of Wool: Reducing the Amount of Chromium in the Residual Bath, W78-07601 5D

### CIRCULATION

Circulation, MESA New York Bight Atlas Monograph 3, W78-07541 2L

### CITIES

Flood Damages on the Iowa River, W78-07258 4A

Hydrogeology of Metropolitan Christchurch, W78-07368 4B

Transformation of the Hydrologic Budget of the Moscow City Area, W78-07376 4C

### CLASSIFICATION

Taxonomic Studies on Aquatic Hyphomycetes, I. Lemonniera de Wildeman, W78-07271 5A

### CLAY LOAM

Rate of Ammonium Nitrification and Nitrate Leaching in Soil Columns, W78-07520 5B

### CLAY MINERAL SURFACE ACIDITY

Protonation of Organic Bases in Clay-Water Systems, W78-07364 5B

### CLAY MINERALS

Protonation of Organic Bases in Clay-Water Systems, W78-07364 5B

### CLAY-WATER SYSTEMS

Protonation of Organic Bases in Clay-Water Systems, W78-07364 5B

### CLAYS

Protonation of Organic Bases in Clay-Water Systems, W78-07364 5B

Effects of Clay Type and Content, Exchangeable Sodium Percentage, and Electrolyte Concentration on Clay Dispersion and Soil Hydraulic Conductivity, W78-07498 2G

Nitrate Movement in Clay Soils and Methods of Pollution Control, W78-07609 5B

### CLEANING

Sewers . . . The Cleaner, The Better, W78-07420 8G

### CLIMATOLOGY

Water Resources and Climatic Change, W78-07380 2A

### COAGULATION

Phosphorus Removal by Precipitation with FE (III), W78-07465 5D

Independent Physical-Chemical Treatment of Raw Sewage, W78-07516 5D

Effect of Time of Deacetylation on Molecular Weight Distribution, Acetyl Content, Viscosity, and Performance of Chitsan as a Conditioning Agent for Activated Sludge, W78-07552 5D

Kinetic Studies on the Lime Sulfurated Solution (Calcium Polysulfide) Process for Removal of Heavy Metals from Waste Water, W78-07595 5D

### COALS

Sedimentary Record of Heavy Metals and Polycyclic Aromatic Hydrocarbons in Lake Constance (In German), W78-07307 5B

### COASTAL MARSHES

City of Newport News and Fort Eustis Tidal Marsh Inventory, W78-07224 2L

Tidal Marsh Bibliography, Selected Key Work Index (Partially Annotated), W78-07226 2L

York County and Town of Poquoson Tidal Marsh Inventory, W78-07310 2L

### COASTAL ZONE

Physical, Chemical, and Biological Characteristics of Nearshore Zone of Sand Key, Florida, Prior to Beach Restoration. Vol. 1, W78-07407 2J

### COASTS

Freshwater Resources of the Oregon Coastal Zones, W78-07281 2L

### COLD WEATHER CONSTRUCTION

Concrete for Building Dams on a Rock Foundation as it Relates to the Problem of Crack Resistance under Severe Climatic Conditions, W78-07362 8F

Dam of the Kolyma Hydroelectric Power Plant, W78-07511 8D

Temperature Regime of Low-Head Earth Dams in Central Yakutia, W78-07512 8D

Calculations of the Thermal Regime of Earthen Dams Considering Their Construction by Layers, W78-07514 8D

### COLI-INDEX

Hygienic Evaluation of Effectiveness of Urban Sewage Purification in Oxidation Ponds (In Russian), W78-07270 5D

### COLIFORMS

Travel of Microorganisms from a Septic Tile, W78-07469 5A

### COLIPHAGES

The Effect of Chemicals on Some Microbial Self-Purification Processes in Bodies of Water (In Russian), W78-07298 5C

### COLOR REMOVAL

Removal of Color from Paper Mill Waste Waters, W78-07238 5D

### COLORADO

Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado, W78-07356 5B

Flooding in Big Thompson River, Colorado, Tributaries: Controls on Channel Erosion and Estimates of Recurrence Interval, W78-07371 4D

Combining Agricultural Improvements and Desalting of Return Flows to Optimize Local Salinity Control Policies, W78-07628 5G

### COLORADO RIVER

Salt Loading in Disturbed Watershed-Field Study, W78-07484 5B

Minimizing Salt in Return Flow by Improving Irrigation Efficiency, W78-07616 5G

The 1973 Agreement on Colorado River Salinity Between the United States and Mexico, W78-07643 6E

### COLORADO RIVER BASIN

Salt Loading in Disturbed Watershed-Field Study, W78-07484 5B

The Hydro-Salinity System in the Grand Valley, W78-07647 5G

Evaluating Appropriate Technologies for Salinity Control in Grand Valley, W78-07649 5G

Development of Best Management Practices for Salinity Control in Grand Valley, W78-07650 5G

### COLUMBIA RIVER

Nitrogen and Water Management to Minimize Return-Flow Pollution from Potato Fields of the Columbia Basin, W78-07611 5G

### COMBINED SEWERS

National Needs for Combined Sewer Overflow Control, W78-07422 5D

Cottage Farm Combined Sewer Detection and Chlorination Station, Cambridge, Massachusetts, W78-07534 5D

### COMMERCIAL FISHING

Management of the Northern Chesapeake Bay American Shad Fishery, W78-07337 6B

# SUBJECT INDEX

## COST COMPARISONS

|                                 |   |    |  |    |   |    |
|---------------------------------|---|----|--|----|---|----|
| Tile,<br>5B                     | <b>COMPETING USES</b><br>Groundwater Law: The Riparian Problem,<br>W78-07578  | 6E | <b>CONSERVATION</b><br>Planning Guidelines for Residential and Path<br>Development in Michigan's Sand Dunes and<br>Wetlands.<br>W78-07227                              | 4A | <b>COPEPODS</b><br>COPEPOD4: A Discrete Time-Delay Model of<br>Copepod Population Dynamics.<br>W78-07289  | 5B |
|                                 | <b>COMPREHENSIVE PLANNING</b><br>Problem Identification and Ranking, An As-<br>sessment of a River Basin Planning Process,<br>W78-07687   | 6B | <b>CONSTRUCTION</b><br>Planning Guidelines for Residential and Path<br>Development in Michigan's Sand Dunes and<br>Wetlands.<br>W78-07227                              | 4A | Adaptation of Copepod Populations to Thermal<br>Stress, II.<br>W78-07398  | 5C |
| Microbial<br>of Water,<br>5C    | <b>COMPUTER MODELS</b><br>Downstream-Upstream Reservoir Routing,<br>W78-07344   | 4A | <b>CONSTRUCTION MATERIALS</b><br>Piping Materials: Little Furor; Some Change.<br>W78-07414   | 8G | <b>COPPER</b><br>Efficacy and Residues of Diquat Applied for<br>Control of Egeria and Hydrilla,<br>W78-07400  | 5G |
|                                 | Preliminary Digital Model of the Arikaree<br>Aquifer in the Sweetwater River Basin, Central<br>Wyoming,<br>W78-07351  | 2F | Effluent Treatment Plant for the Smaller Com-<br>munity,<br>W78-07428  | 5D | Sewage System Rejuvenation.<br>W78-07535  | 8G |
| Capacity<br>Drainage to<br>5B   | Lined: A One Dimensional Multireach Sedi-<br>ment Transport Model,<br>W78-07363   | 2J | Aeration Plant for Small Communities.<br>W78-07431   | 5D | Plater Meets 'New Source' Requirements,<br>W78-07593  | 5D |
|                                 | Groundwater Recharge and Coastal Discharge<br>for the Northwest Coast of the Island of<br>Hawaii: A Computerized Water Budget Ap-<br>proach,<br>W78-07394   | 2F | Wastewater System Provides New Water<br>Source for St. Petersburg.<br>W78-07432  | 5D | Trace Metal-Chelator Interactions and<br>Phytoplankton Growth in Seawater Media:<br>Theoretical Analysis and Comparison with Re-<br>ported Observations,<br>W78-07663   | 5C |
| Colorado,<br>Division and<br>4D | Free Surface Flow Computations by Charac-<br>teristics,<br>W78-07493  | 2E | Sewage Treatment Equipment for Single<br>Households to 5000 PE.<br>W78-07439   | 5D | Copper Sensitivity of Gonyaulax Tamarensis,<br>W78-07664  | 5C |
|                                 | Urban Hydrological Modeling and Catchment<br>Research in India,<br>W78-07690  | 2A | Sewage Treatment Rotary Distributor Range<br>Extended.<br>W78-07658  | 5D | A Preliminary Study of the Use of Benthic<br>Algae as Biological Indicators of Heavy Metal<br>Pollution in Sorfjorden, Norway,<br>W78-07665   | 5A |
| Improving<br>5G                 | <b>COMPUTER PROGRAMS</b><br>IBM 1130 Computation Process in the Study of<br>Biophysical Constants Variations of<br>Pathogenic Bacteria by Phytoplankton,<br>W78-07264   | 5C | <b>CONTAINMENT AREA</b><br>An Evaluation of Oil and Grease Contamina-<br>tion Associated with Dredged Material Contain-<br>ment Areas.<br>W78-07681                    | 5G | <b>COPPER SULFATE</b><br>Preservation of Phenolic Compounds in Waste-<br>waters,<br>W78-07586   | 5D |
|                                 | COPEPOD4: A Discrete Time-Delay Model of<br>Copepod Population Dynamics,<br>W78-07289   | 5B | <b>CONTAINMENT AREAS</b><br>Containment Area Management to Promote<br>Natural Dewatering of Fine-Grained Dredged<br>Material,<br>W78-07673                             | 5E | <b>COPROSTANOL</b><br>Mississippi River Basin Sterol Assay Project<br>Report. Coprostanol, A Positive Molecular<br>Marker of Domestic and Run-Off Sewage,<br>Wastewater Plant Effluent and Surface Waters<br>in the Burlington, Iowa Area on the Mississippi<br>River,<br>W78-07329 | 5A |
| hed-Field<br>5B                 | Downstream-Upstream Reservoir Routing,<br>W78-07344   | 4A | Sizing of Containment Areas for Dredged<br>Material,<br>W78-07674  | 5E | <b>COPROSTANOLS</b><br>Missouri River Basin Sterol Assay Project Re-<br>port. Coprostanol, A Positive Marker of<br>Domestic and Run-Off Pollution: Sterol Assay<br>of Wastewater Plant Effluents and Surface<br>Waters of the Lower Main Stem Missouri,<br>W78-07328                | 5A |
|                                 | Unsteady-State Water-Quality Model,<br>W78-07348  | 5B | <b>CONTINENTAL SHELF</b><br>Surface Currents as Determined by Drift Card<br>Releases Over the Continental Shelf Off Cen-<br>tral and Southern California,<br>W78-07556 | 5B | <b>CORALVILLE DAM (IOWA)</b><br>Flood Damages on the Iowa River,<br>W78-07258   | 4A |
| rand Val-<br>5G                 | Capacity Planning for Regional Wastewater<br>Treatment Systems,<br>W78-07521  | 5D | <b>CONVEYANCE STRUCTURES</b><br>Hoscar's Extension Should Deodorize the<br>Douglas,<br>W78-07418   | 5D | <b>CORES</b><br>A Coring and Squeezing Technique for the<br>Detailed Study of Subsurface Water Chemis-<br>try,<br>W78-07575   | 2K |
|                                 | <b>CONCRETE PIPES</b><br>Wastewater Effluent Line Serves Dual Pur-<br>pose,<br>W78-07419  | 5E | Sewers . . . The Cleaner, The Better.<br>W78-07420   | 8G | <b>CORN (FIELD)</b><br>Soil Nitrate Concentrations in Corn Plots<br>Treated with Isotopically Labeled Nitrogen<br>Fertilizer,<br>W78-07614  | 5B |
| Practices<br>5G                 | <b>CONCRETE PLANTS</b><br>Modular Treatment Plant.<br>W78-07659   | 5D | <b>COOLING WATER</b><br>Removal of Chromium, Chromate, Molybdate<br>and Zinc,<br>W78-07231   | 5D | <b>CORROSION CONTROL</b><br>Odor and Corrosion Control.<br>W78-07430  | 5D |
|                                 | <b>CONCRETES</b><br>Concrete for Building Dams on a Rock Founda-<br>tion as it Relates to the Problem of Crack Re-<br>sistance under Severe Climatic Conditions,<br>W78-07362   | 8F | <b>COOPER RIVER (SC)</b><br>Dispersion of Proposed Effluent Discharges<br>and Saltwater Intrusion in Cooper River;<br>Hydraulic Model Investigation,<br>W78-07670      | 5B | <b>COST COMPARISONS</b><br>Evaluation of the Cost-Effectiveness of Non-<br>structural Pollution Controls: A Manual for<br>Water Quality Management Planning,<br>W78-07336   | 5G |
| Minimize<br>Fields of<br>5G     | <b>CONDITIONING AGENTS</b><br>Effect of Time of Deacetylation on Molecular<br>Weight Distribution, Acetyl Content, Viscosity,<br>and Performance of Chitsan as a Conditioning<br>Agent for Activated Sludge,<br>W78-07552 | 5D | <b>COPEPOD4</b><br>COPEPOD4: A Discrete Time-Delay Model of<br>Copepod Population Dynamics,<br>W78-07289   | 5B |   |    |
|                                 | <b>CONFERENCES</b><br>First Four Decades of the Hydraulics Division,<br>W78-07382   | 2A |  |    |   |    |

# SUBJECT INDEX

## COST EFFECTIVENESS

### COST EFFECTIVENESS

Evaluation of the Cost-Effectiveness of Non-structural Pollution Controls: A Manual for Water Quality Management Planning, W78-07336 5G

### COSTS

Production of Monosex White Amur for Aquatic Plant Control, W78-07326 4A

Alabama, (State Capital News), W78-07523 5D

NWWA's Most Requested Statistics, W78-07582 8A

### CROP PRODUCTION

The Role of EPA's Office of Research and Development in Irrigated Crop Production Research, W78-07607 5G

### CROPS

Flood Damages on the Iowa River, W78-07258 4A

### CULVERTS

Sewage System Rejuvenation, W78-07535 8G

### CURRENTS (WATER)

Computation of the Pattern of Currents in Rivers and Nonstratified Reservoirs, W78-07502 2E

### CYANIDES

Method for Purification of Industrial Waste Water, W78-07247 5D

### CYANOPHYTA

Anaerobic ATP Levels in the Blue-Green Alga Anabaena: Dark-Light Transients and Effects of Light Intensity, W78-07303 5C

Characterization of Sulphate Uptake in Anacystis Nidulans, W78-07304 5C

### CYTOLOGICAL STUDIES

Evolutionary Studies on the Shape of the Cell and of the Chloroplast in Desmids, W78-07283 2I

### CZECHOSLOVAKIA

Preliminary Tests of the Influence of Waste Waters from Sugar Factories on the Numbers of Intestinal Bacteria in Water (In German), W78-07223 5C

### DAIRY INDUSTRY

Industrial Waste Management in the Dairy Industry in Poland, W78-07590 5D

### DALLAS (TX)

Dallas Urban Runoff, Storm of February 11, 1977, W78-07361 2B

### DAMS

Concrete for Building Dams on a Rock Foundation as it Relates to the Problem of Crack Resistance under Severe Climatic Conditions, W78-07362 8F

Dam of the Kolyma Hydroelectric Power Plant, W78-07511 8D

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A:

Rocky Mountains and Pacific Northwest (Executive Summary), W78-07563 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Executive Summary), W78-07564 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish Wildlife, Part B: California (Final Report), W78-07565 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Case Studies), W78-07566 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Final Report), W78-07567 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Rocky Mountain Region Case Studies), W78-07568 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Pacific Northwest Region Case Studies), W78-07569 6G

### DARDENELE LAKE (ARK)

Radionuclide Concentrations in the Arkansas River Upstream and Downstream from the Nuclear I Power Generating Facility, W78-07320 5B

### DATA COLLECTIONS

An In Situ Study of Recruitment, Growth and Survival of Subtidal Marine Algae: Techniques and Preliminary Results, W78-07308 5C

Index of Surface-Water Stations in Texas, October 1977, W78-07312 7C

Handbook-Index of Hawaii Groundwater and Resources Data, Extracted from Reports of the Water Resources Research Center, University of Hawaii, Volume I, W78-07395 7C

Water/Wastewater Survey Guidelines, W78-07522 5A

U.S. IFYGL Ship System: Description of Archived Data, W78-07554 2H

Urban Hydrological Modeling and Catchment Research in India, W78-07690 2A

### DATING

North American Glacial History Extended to 75,000 Years Ago, W78-07372 2C

### DDD

A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem, W78-07667 5A

### DDE

Analysis of Various Iowa Waters for Selected Pesticides: Atrazine, DDE, and Dieldrin--1974, W78-07331 5A

Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W78-07661 5C

A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem, W78-07667 5A

### DDT

Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W78-07661 5C

A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem, W78-07667 5A

### DEATH RATE

Method of Average Birth and Death Rate Evaluation in the Marine-Terrestrial Bacteria Interactions, W78-07263 5C

IBM 1130 Computation Process in the Study of Biophysical Constants Variations of Pathogenous Bacteria by Phytoplankton, W78-07264 5C

### DECIDUOUS FORESTS

Natural Sewage Recycling Systems W78-07515 5D

### DECISION-MAKING

A Generalized Water Quality Model for Eutrophic Lakes and Reservoirs, W78-07290 5C

Instream Flow Decision-Making in the Pacific Northwest, W78-07480 6E

### DECOMPOSING ORGANIC MATTER

Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C

### DEFLECTION

PVC Pipe Passes Performance and Cost Tests, W78-07479 8G

### DEGRADATION

Plants and Systems for Composting of Sewage Sludges in the Federal Republic of Germany--State of the Art and Trends (Anlagen und Systeme zur Kompostierung von Abwässerschlämmen in der Bundesrepublik Deutschland--Stand sowie Tendenzen), W78-07449 5E

### DEGRADATION (DECOMPOSITION)

Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C

### DELAWARE RIVER

Macrobenthos of the Tidal Delaware River Between Trenton and Burlington, New Jersey, W78-07300 5C



# SUBJECT INDEX

## DEMINERALIZATION

- Treatment of Water to Remove Certain Ions Therefrom, W78-07246 5F

## DEMONSTRATION WATERSHEDS

- Urban Hydrological Modeling and Catchment Research in France, W78-07694 2A

## DENITRIFICATION

- Nitrogen Transformation in Lakes, W78-07262 5C  
Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C  
Solubilization of Organic Carbon During the Acid Phase of Anaerobic Digestion, W78-07518 5D  
Field Measured Flux of Volatile Denitrification Products as Influenced by Soil Water Content and Organic Carbon Source, W78-07613 5G

## DENMARK

- Nitrogen Transformation in Lakes, W78-07262 5C

## DESALINATION

- Combining Agricultural Improvements and Desalting of Return Flows to Optimize Local Salinity Control Policies, W78-07628 5G  
An Assessment of Irrigation Efficiencies and Drainage Return Flows from the Wellton-Mohawk Division of the Gila Project, W78-07644 3C

## DESERTS

- Flood-Hazard Study--100-Year Flood Stage for Lucerne Lake, San Bernardino County, California, W78-07359 4A

## DESIGN

- Design of Constant Accuracy Linear Proportional Weir, W78-07492 8B

## DESIGN DATA

- Rainfall and Runoff Data from Small Basins in Wyoming, W78-07349 7C  
Effluent Treatment Plant for the Smaller Community, W78-07428 5D  
Aeration Plant for Small Communities, W78-07431 5D  
CIRIA Streamlines Tank Design, W78-07549 5D  
Wastewater Treatment System, W78-07580 5D  
Sewage Treatment Rotary Distributor Range Extended, W78-07658 5D

## DESIGN STANDARDS

- CIRIA Streamlines Tank Design, W78-07549 5D

## DESMIDS

- Evolutionary Studies on the Shape of the Cell and of the Chloroplast in Desmids, W78-07283 2I

- Morphological Investigations of Asymmetry in Desmids, W78-07284 2I

- Eulimnion, an Original Place of New Forms, W78-07285 5C

## DESTRATIFICATION

- Hydraulic Modeling of Mixing in Stratified Lakes, W78-07218 5B

## DEWATERING

- Pretreatment Filter Press Dewatering System, W78-07254 5D  
Treatment and Use of Sewage Purification Plant Sludges, W78-07425 5D  
The Use of Filterbelt Presses for Dewatering of Sewage Sludges, W78-07426 5D  
Filter Sack Dewatering, W78-07429 5D  
The Thickening and Centrifuging of Sludge, W78-07436 5D  
Heat Treatment and Pressing of Digested Sludge, W78-07437 5D  
Sewage Sludge Lime Dosing and Filter Press Feeding, W78-07438 5D  
Belt Press Sludge Dewatering Machines, W78-07440 5D  
Effect of Thermal Pretreatment on Digestibility and Dewaterability of Organic Sludges, W78-07457 5D  
Sewage Dewatering Plant for Small Communities, W78-07660 5D  
A Multi-Stage Filter Belt Press, W78-07666 5E  
Solids Dewatering, W78-07675 5E

## DEWATERING DREDGING

- Containment Area Management to Promote Natural Dewatering of Fine-Grained Dredged Material, W78-07673 5E

## DIALYSIS

- A New Dialysis-Ion Exchange Technique for Determining the Forms of Trace Metals in Water, W78-07277 5A

## DIATOMS

- Trace Metal-Ohelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations, W78-07663 5C

## DICOP

- Aquatic Weed Control in Small Reservoirs with Diquat, W78-07402 5G

## DIELDRIN

- Analysis of Various Iowa Waters for Selected Pesticides: Atrazine, DDE, and Dieldrin--1974, W78-07331 5A

## DISINFECTION

- Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W78-07661 5C

- A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem, W78-07667 5A

## DIFFUSION

- Circumferential Diffusion in Pipe Mixing, W78-07488 8B

## DIGITAL COMPUTERS

- Vortex-Shedding Flowmeters, W78-07459 7B

## DILUTION

- Model Study of Cool Water Discharge from Proposed LNG Facility, Los Angeles Harbor, California, W78-07669 5B

## DINOFLAGELLATES

- Marine Pollution Hazards, W78-07297 5C  
Copper Sensitivity of Gonyaulax Tamarensis, W78-07664 5C

## DIQUAT

- Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, W78-07399 5G  
Efficacy and Residues of Diquat Applied for Control of Egeria and Hydrilla, W78-07400 5G  
Aquatic Weed Control in Small Reservoirs with Diquat, W78-07402 5G  
Final Environmental Statement for Walker Dam Impoundment, Aquatic Plant Control Project, New Kent County, Virginia, W78-07403 6G

## DISASTERS

- Flooding in Big Thompson River, Colorado, Tributaries: Controls on Channel Erosion and Estimates of Recurrence Interval, W78-07371 4D

## DISCHARGE (WATER)

- Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1977 Water Year, W78-07345 4A

- Cottage Farm Combined Sewer Detection and Chlorination Station, Cambridge, Massachusetts, W78-07534 5D

- Model Study of Cool Water Discharge from Proposed LNG Facility, Los Angeles Harbor, California, W78-07669 5B

## DISEASES

- Some Parasites and Diseases of Estuarine Fishes in Polluted Habitats of Mississippi, W78-07546 5C

## DISINFECTION

- Gamma Ray Treatment Reaps Harvest from Sewage, W78-07333 5D  
The Dangers of Inadequate Chlorination of Polluted Waters, W78-07435 5D

# SUBJECT INDEX

## DISINFECTION

- Recent Advances in Ozone Technology,  
W78-07444 5D
- Chlorine Detector Saves a Life.  
W78-07453 5A
- Virion Aggregation and Disinfection of Water  
Viruses by Bromine,  
W78-07524 5F

## DISPERSION

- Dispersion in Soil Columns: Effect of Boundary  
Conditions and Irreversible Reactions,  
W78-07386 2G
- Two-Dimensional Plume in Uniform Ground-  
Water Flow,  
W78-07490 5B
- Dispersion of Proposed Effluent Discharges  
and Saltwater Intrusion in Cooper River;  
Hydraulic Model Investigation,  
W78-07670 5B

## DISSOLVED GASES

- Improved Under-Water Sampler for Limnological  
Work,  
W78-07276 7B

## DISSOLVED ORGANIC MATTER (DOM)

- The Utilization of Dissolved Organic Com-  
pounds in Aquatic Environments,  
W78-07296 5C

## DISSOLVED OXYGEN

- Nitrogen Transformations in Land Treatment,  
W78-07216 5B

## DISSOLVED SOLIDS

- Water Quality Model for the Upper North  
Platte River,  
W78-07206 5B
- Evaluation of Surface Irrigation Return Flows  
in the Central Valley of California,  
W78-07624 5B

## DISTRIBUTION

- Effect of Three Irrigation Systems on Distribution  
of Fertilizer Nitrate Nitrogen in Soil,  
W78-07610 5B

## DISTRIBUTION PATTERNS

- Water Distribution Patterns for Sprinkler and  
Surface Irrigation Systems,  
W78-07631 3F

## DISTRIBUTION SYSTEMS

- Sewage Treatment Rotary Distributor Range  
Extended,  
W78-07658 5D

## DITCHES

- A Variational Inequality Method Applied to  
Free Surface Seepage from a Triangular Ditch,  
W78-07390 4A

## DOMESTIC WASTES

- A Test of the Effects of Domestic Sewage on  
the Growth of the Common Blue Mussel, *Mytilus*  
*edulis*, in an Aquacultural System,  
W78-07205 5C
- Water Purifying Device Without Movable  
Mechanical Part in Contact with the Liquid to  
be Treated,  
W78-07252 5D
- Night Soil Treatment by 'Denipac Process'--  
Kawamuko Treatment Plant, Matsue City (2).  
(Denipakku puroseshi ni yoru shinyo shori-mat-  
sue shi kawamuko shoriyo),  
W78-07478 5D

- The Development of a Hydropem (TM)  
Microfiltration System for the Treatment of  
Domestic Wastewater Effluents,  
W78-07526 5D

## DOUGLAS COUNTY (OREG)

- Availability and Quality of Ground Water in the  
Drain-Yoncalla Area, Douglas County, Oregon,  
W78-07347 7C

## DRAG

- Drag on Baffle Walls in Hydraulic Jump,  
W78-07491 8B

## DRAINAGE

- Economic and Agronomic Effects of High Ir-  
rigation Levels on Alfalfa and Barley,  
W78-07397 3F
- Variation of Drainage Density in a Small  
British Columbia Watershed,  
W78-07505 4D

## DRAINAGE EFFECTS

- Effects of Stream Channelization on Terrestrial  
Wildlife and Their Habitats in the Buena Vista  
Marsh, Wisconsin,  
W78-07228 6G

## DRAINAGE PRACTICES

- Agricultural Drainage Problems of the San  
Joaquin Valley,  
W78-07636 4A
- A Valleywide Solution--The Interagency  
Drainage Program,  
W78-07639 4A

## DREDGED MATERIAL

- Containment Area Management to Promote  
Natural Dewatering of Fine-Grained Dredged  
Material,  
W78-07673 5E
- Sizing of Containment Areas for Dredged  
Material,  
W78-07674 5E
- An Evaluation of Oil and Grease Contamina-  
tion Associated with Dredged Material Contain-  
ment Areas,  
W78-07681 5G

## DREDGED MATERIAL DISPOSAL

- Patterns of Succession in Benthic Infaunal  
Communities Following Dredging and Dredged  
Material Disposal in Monterey Bay,  
W78-07677 5C
- Identification of Alternative Power Sources for  
Dredged Material Processing Operations,  
W78-07680 8C
- Feasibility of Inland Disposal of Dewatered  
Dredged Material: A Literature Review,  
W78-07682 5E

## DREDGING

- Physical, Chemical, and Biological Charac-  
teristics of Nearshore Zone of Sand Key,  
Florida, Prior to Beach Restoration. Vol. 1,  
W78-07407 2J
- Patterns of Succession in Benthic Infaunal  
Communities Following Dredging and Dredged  
Material Disposal in Monterey Bay,  
W78-07677 5C

## DRILLING

- State Agencies and Officials Responsible for  
Water Well Industry Codes and Licensing,  
W78-07573 6F

- Water Well Industry Codes and Licensing,  
W78-07574 6F
- NWWA's Most Requested Statistics,  
W78-07582 8A

## DRILLING EQUIPMENT

- Flexodrill Monitors Borehole Continuously,  
W78-07579 8G

## DUNES

- Planning Guidelines for Residential and Path  
Development in Michigan's Sand Dunes and  
Wetlands,  
W78-07227 4A

## DYE DISPERSION

- Dye Infusion Technique Assesses Stream Pol-  
lution in Ohio,  
W78-07373 5B
- Dispersion of Proposed Effluent Discharges  
and Saltwater Intrusion in Cooper River;  
Hydraulic Model Investigation,  
W78-07670 5B

## DYE RELEASES

- Dye Infusion Technique Assesses Stream Pol-  
lution in Ohio,  
W78-07373 5B

## DYES

- Adsorption of Textile Dyes by Activated Car-  
bon Produced from Agricultural, Municipal and  
Industrial Wastes,  
W78-07599 5D
- Dye Waste Treatment and Reuse,  
W78-07600 5D
- Chrome Dyeing of Wool: Reducing the Amount  
of Chromium in the Residual Bath,  
W78-07601 5D
- Model Study of Cool Water Discharge from  
Proposed LNG Facility, Los Angeles Harbor,  
California,  
W78-07669 5B

## E-COLI

- The Effect of Chemicals on Some Microbial  
Self-Purification Processes in Bodies of Water  
(In Russian),  
W78-07298 5C
- The Dangers of Inadequate Chlorination of Pol-  
luted Waters,  
W78-07435 5D

## EARTH DAMS

- Temperature Regime of Low-Head Earth Dams  
in Central Yakutia,  
W78-07512 8D
- Effect of Nonlinear Air Filtration on Thermal  
Regime of Rock-Fill Dam,  
W78-07513 8D
- Calculations of the Thermal Regime of Earthen  
Dams Considering Their Construction by  
Layers,  
W78-07514 8D

## ECOLOGICAL

- Ecological Components Structuring the  
Seaward Edges of Tropical Pacific Reefs: The  
Distribution, Communities and Productivity of  
Porolithothamnion,  
W78-07327 2I

## ECONOMIC IMPACT

- Economic Impact of Water Quality on River  
Basin Management,  
W78-07396 5G

# SUBJECT INDEX

## EUTROPHICATION

### ECONOMICS

An Economic Analysis of Irrigation Return Flow Recycle Systems in the Central Valley of California, W78-07625 5G

Economic Analysis of On-Farm Methods for Controlling Sediment and Nutrient Losses, W78-07627 5G

Economics of Controlling Irrigation Return Flow in the Mesilla Valley, New Mexico, W78-07635 5G

### EFFICIENCIES

Conserve Energy in Wastewater Systems, W78-07476 5D

### EFFLUENT STREAMS

The Behavior of F2 Coliphage in Activated Sludge Treatment, W78-07461 5D

### EFFLUENTS

Suggested Method for Vanadate Removal from Mill Effluents, W78-07332 5D

Effluent Mixing Zone in a Shallow River, W78-07483 5B

Dispersion of Proposed Effluent Discharges and Saltwater Intrusion in Cooper River; Hydraulic Model Investigation, W78-07670 5B

### EGERIA DENSE

Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, W78-07399 5G

Efficacy and Residues of Diquat Applied for Control of Egeria and Hydrilla, W78-07400 5G

Greenhouse Studies of the Growth and Reproduction of Egeria Densa, W78-07401 4A

### ELECTRIC POWER

Conserve Energy in Wastewater Systems, W78-07476 5D

### ELECTRICAL CONDUCTANCE

Dielectric Constant and Electroconductance of Some Dry Frost-Prone Soils, W78-07369 2C

Effects of Clay Type and Content, Exchangeable Sodium Percentage, and Electrolyte Concentration on Clay Dispersion and Soil Hydraulic Conductivity, W78-07498 2G

### ELECTRON MICROSCOPY

Virion Aggregation and Disinfection of Water Viruses by Bromine, W78-07524 5F

### ENDOTHALE

Final Environmental Statement for Walker Dam Impoundment, Aquatic Plant Control Project, New Kent County, Virginia, W78-07403 6G

### ENDRIN

Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W78-07661 5C

### ENERGY

Conserve Energy in Wastewater Systems, W78-07476 5D

Energy and Water, W78-07508 6D

### ENERGY CONSUMPTION

An Energy Model of Pennsylvania, W78-07685 6A

### ENERGY DEMAND

An Energy Model of Pennsylvania, W78-07685 6A

### ENERGY DEVELOPMENT

Energy and Water, W78-07508 6D

### ENERGY MODELS

An Energy Model of Pennsylvania, W78-07685 6A

### ENERGY SUPPLY

An Energy Model of Pennsylvania, W78-07685 6A

### ENGLAND

Water Resources and Climatic Change, W78-07380 2A

### ENVIRONMENTAL EFFECTS

The Impact of the 1975 Bonnet Carre Spillway Opening on Epifaunal Invertebrates in Southern Lake Pontchartrain, W78-07219 5C

Shoreline Plant Establishment and Use of a Wave-Stilling Device, W78-07230 2L

Final Environmental Statement for Walker Dam Impoundment, Aquatic Plant Control Project, New Kent County, Virginia, W78-07403 6G

Physical, Chemical, and Biological Characteristics of Nearshore Zone of Sand Key, Florida, Prior to Beach Restoration. Vol. 1, W78-07407 2J

Marine Waste Disposal in the New York Bight—Public Policy, Environmental Impacts, and Alternative Futures, W78-07529 5E

### ENVIRONMENTAL PROTECTION

Sub-Seabed Disposal of Radioactive Waste: Prevention or Management, W78-07536 5E

### ENZYMES

Mutant Bacteria Solve BOD Problem at Heat Packing Plant, W78-07603 5D

### EPHEMERAL STREAMS

Rainfall and Runoff Data from Small Basins in Wyoming, W78-07349 7C

Scour and Fill in Steep, Sand-Bed Ephemeral Streams, W78-07379 2J

### EQUATIONS

The Use of Galerkin Finite-Element Methods to Solve Mass-Transport Equations, W78-07354 5B

### EQUILIBRIUM

Trace Metal-Chelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations, W78-07663 5C

### EQUIPMENT

Nuisance-Algae Control Through Mechanical Harvesting, W78-07266 5G

Belt Press Sludge Dewatering Machines, W78-07440 5D

Wastewater Treatment System, W78-07580 5D

### ERODIBILITY

A Simple Laboratory Apparatus to Measure Relative Erodibility of Soils, W78-07504 2J

### EROSION

A Simple Laboratory Apparatus to Measure Relative Erodibility of Soils, W78-07504 2J

Management Guidelines for Controlling Sediments, Nutrients, and Adsorbed Biocides in Irrigation Return Flows, W78-07622 5G

### EROSION RATES

A Simple Laboratory Apparatus to Measure Relative Erodibility of Soils, W78-07504 2J

### ESTUARIES

Water-Column and Benthic Invertebrate and Plant Associations as Affected by the Physico-Chemical Aspects in a Mesotrophic Bayou Estuary Pensacola, Florida, W78-07203 5C

Composition of Suspensions and Sediments in the Estuaries of the Northern Dvina, Mezen', Pechora, and Ob' Rivers, W78-07405 2L

Development of a Two Dimensional Hydrodynamic Numerical Model for Use in a Shallow, Well-Mixed Estuary, W78-07408 2L

Circulation. MESA New York Bight Atlas Monograph 3, W78-07541 2L

Some Parasites and Diseases of Estuarine Fishes in Polluted Habitats of Mississippi, W78-07546 5C

Use of Benthic Sediments as Indicators of Marina Flushing, W78-07553 5A

Generation of Tidal Current and Height Charts for Narragansett Bay Using a Numerical Model, W78-07555 2L

### EULIMNION

Eulimnion, an Original Place of New Forms, W78-07285 5C

### EUROPE

Urban Hydrological Modeling and Catchment Research: International Summary, W78-07689 2A

### EURYTEMORA AFFINIS

Adaptation of Copepod Populations to Thermal Stress, II, W78-07398 5C

### EUTROPHICATION

An Analytical Evaluation of the Utilization and Management of Water Resources in the Lake Metigoshe Watershed, North Dakota, W78-07209 5C



# EUTROPHICATION

Nuisance-Algae Control Through Mechanical Harvesting.  
W78-07266 5G

West Point Lake Postimpoundment Study,  
W78-07287 5C

A Generalized Water Quality Model for Eutrophic Lakes and Reservoirs,  
W78-07290 5C

Restoration of Lower St. Regis Lake (Franklin County, New York),  
W78-07291 5G

Marine Pollution Hazards,  
W78-07297 5C

Macrobenthos of the Tidal Delaware River Between Trenton and Burlington, New Jersey,  
W78-07300 5C

## EVAPORATION

Hydrological Studies on a Small Basin on the Canadian Shield.  
W78-07406 2H

## EVAPORATORS

Plater Meets 'New Source' Requirements,  
W78-07593 5D

## EVOLUTION

Evolutionary Studies on the Shape of the Cell and of the Chloroplast in Desmids,  
W78-07283 2I

Eulimnion, an Original Place of New Forms,  
W78-07285 5C

## EXCAVATION

PVC Pipe Passes Performance and Cost Tests,  
W78-07479 8G

## EXCESSIVE PRECIPITATION

Analysis of Intense Precipitation in the Krasnoyarsk Area,  
W78-07374 2B

## EXTENDED AERATION

Rotating Disc Sewage Treatment Systems for Suburban Developments and High-Density Resorts of Hawaii,  
W78-07393 5D

## FAIRFIELD (CT)

Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut,  
W78-07334 5A

## FARM WASTES

Performance of a Trickling Filter, Solids Removal, and Anaerobic Digestion System for Recycled Poultry Manure Wastewater,  
W78-07207 5D

Submission by the Institute of Water Pollution Control to the Royal Commission on Environmental Pollution on 'Environmental Pollution and Agriculture'.  
W78-07473 5B

## FEASIBILITY STUDIES

An Engineering Report on Selected Reservoir Sites in the Bandon Area,  
W78-07280 6B

## FECUNDITY

A Comparative Study of the Effects of Mercuric Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, Artemia Salina,  
W78-07668 5C

## FEDERAL REPUBLIC OF GERMANY

Urban Hydrology Studies and Mathematical Modeling in the Federal Republic of Germany.  
W78-07696 2A

## FERTILITY

A Comparative Study of the Effects of Mercuric Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, Artemia Salina,  
W78-07668 5C

## FERTILIZATION

Submission by the Institute of Water Pollution Control to the Royal Commission on Environmental Pollution on 'Environmental Pollution and Agriculture'.  
W78-07473 5B

Proceedings of National Conference: Irrigation Return Flow Quality Management.  
W78-07606 5G

## FERTILIZERS

Sludge Disposal: The Problem, The Search, The Solution,  
W78-07424 5D

Plants and Systems for Composting of Sewage Sludges in the Federal Republic of Germany--State of the Art and Trends (Anlagen und Systeme zur Kompostierung von Abwässerschlämmen in der Bundesrepublik Deutschland--Stand sowie Tendenzen).  
W78-07449 5E

Effect of Three Irrigation Systems on Distribution of Fertilizer Nitrate Nitrogen in Soil,  
W78-07610 5B

Soil Nitrate Concentrations in Corn Plots Treated with Isotopically Labeled Nitrogen Fertilizer,  
W78-07614 5B

## FESCUES

Soil Strength and Soil Temperature: Their Effects on Root Growth of Tall Fescue,  
W78-07688 2G

## FILTER PRESSES

Pretreatment Filter Press Dewatering System,  
W78-07254 5D

## FILTERS

Element for Filtering and Separating Fluid Mixtures,  
W78-07240 5D

Hoscar's Extension Should Deodorize the Douglas,  
W78-07418 5D

Sewage Treatment Equipment for Single Households to 5000 PE.  
W78-07439 5D

Belt Press Sludge Dewatering Machines.  
W78-07440 5D

Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater,  
W78-07463 5F

Arrestment of Fumes in the Non-Ferrous Metals Industry,  
W78-07596 5G

Modular Treatment Plant.  
W78-07659 5D

A Multi-Stage Filter Belt Press.  
W78-07666 5E

Solids Dewatering.  
W78-07675 5E

## FILTRATION

Element for Filtering and Separating Fluid Mixtures,  
W78-07240 5D

Method for Clarifying Waste Water Containing Finely Divided Oily Materials,  
W78-07245 5D

Filter Sack Dewatering.  
W78-07429 5D

A Pilot Plant Study on Advanced Treatment of Treated Sewage for Re-Use, (In Japanese),  
W78-07445 5D

Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater,  
W78-07463 5F

The Development of a Hydropem (TM) Microfiltration System for the Treatment of Domestic Wastewater Effluents,  
W78-07526 5D

Cross-Flow Filtration in Physical-Chemical Treatment of Municipal Sewage Effluents,  
W78-07533 5D

Solids Dewatering.  
W78-07675 5E

## FINANCING

Alabama, (State Capital News),  
W78-07523 5D

## FINITE ELEMENT ANALYSIS

Comparison of Numerical Simulation Flow Models for Coastal Inlets,  
W78-07472 2L

## FISH

Studies on the Toxicity of Ammonia, Nitrate and their Mixtures to Guppy Fry,  
W78-07214 5C

Nearshore Fish and Macroinvertebrate Assemblages Along the Strait of Juan de Fuca Including Food Habits of Nearshore Fish,  
W78-07543 2L

## FISH BEHAVIOR

Temperature Requirements of Salmonids in Relation to Their Feeding, Bioenergetics, Growth and Behavior,  
W78-07322 5C

## FISH FARMING

Use of Zooplanktophagic Fishes in Channel Catfish Production Ponds,  
W78-07292 5C

## FISH HATCHERIES

Northern Pike Production in Managed Spawning and Rearing Marshes,  
W78-07293 5C

Production of Monosex White Amur for Aquatic Plant Control,  
W78-07326 4A

## FISH MANAGEMENT

Northern Pike Production in Managed Spawning and Rearing Marshes,  
W78-07293 5C

Management of the Northern Chesapeake Bay American Shad Fishery,  
W78-07337 6B

# SUBJECT INDEX

## FOOD PROCESSING INDUSTRY

### FISH REPRODUCTION

Northern Pike Production in Managed  
Spawning and Rearing Marshes,  
W78-07293 5C

### FISH STOCKING

Northern Pike Production in Managed  
Spawning and Rearing Marshes,  
W78-07293 5C

### FISHERIES

Management of the Northern Chesapeake Bay  
American Shad Fishery,  
W78-07337 6B

Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Executive Summary),  
W78-07563 6G

Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part B:  
California (Executive Summary),  
W78-07564 6G

Assessment of Effects of Altered Stream Flow  
Characteristics on Fish Wildlife, Part B:  
California (Final Report),  
W78-07565 6G

Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part B:  
California (Case Studies),  
W78-07566 6G

Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest (Final  
Report),  
W78-07567 6G

Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Rocky Mountain Region Case Studies),  
W78-07568 6G

Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Pacific Northwest Region Case Studies),  
W78-07569 6G

### FIXED-BED MODELS

Improvements for Little River Inlet, South  
Carolina; Hydraulic Model Investigation,  
W78-07671 8B

### FLASH FLOODS

Flooding in Big Thompson River, Colorado,  
Tributaries: Controls on Channel Erosion and  
Estimates of Recurrence Interval,  
W78-07371 4D

### FLOATING ICE

Visual Observations of Floating Ice from  
Skylab,  
W78-07346 2C

### FLOCCULATION

Method for Purification of Industrial Waste  
Water,  
W78-07247 5D

The Use of Filterbelt Presses for Dewatering of  
Sewage Sludges,  
W78-07426 5D

Air vs 02: Two Activated Sludge Systems Com-  
pared,  
W78-07451 5D

### FLOOD CONTROL

Nonstructural Floodplain Planning,  
W78-07221 6F

Effect of the Small Watershed Program on  
Major Uses of Land: Examination of 60 Pro-  
jects in the Southeast. Mississippi Delta, and  
Missouri River Tributaries Regions,  
W78-07330 4D

### FLOOD DAMAGE

Flood Damages on the Iowa River,  
W78-07258 4A

### FLOOD FORECASTING

Technique for Estimating Magnitude and  
Frequency of Floods in Illinois,  
W78-07350 4A

Frequency Analysis of Illinois Floods Using  
Observed and Synthetic Streamflow Records,  
W78-07355 4A

### FLOOD FREQUENCY

Technique for Estimating Magnitude and  
Frequency of Floods in Illinois,  
W78-07350 4A

Frequency Analysis of Illinois Floods Using  
Observed and Synthetic Streamflow Records,  
W78-07355 4A

Flood-Hazard Study--100-Year Flood Stage for  
Lucerne Lake, San Bernardino County,  
California,  
W78-07359 4A

### FLOOD PEAK

Frequency Analysis of Illinois Floods Using  
Observed and Synthetic Streamflow Records,  
W78-07355 4A

### FLOOD PLAIN ZONING

Nonstructural Floodplain Planning,  
W78-07221 6F

### FLOOD PLAINS

Floodplain Delineation Using LANDSAT-1  
Data,  
W78-07510 4A

### FLOOD ROUTING

State Variable Model for Sewer Network Flow  
Routing,  
W78-07212 8B

Downstream-Upstream Reservoir Routing,  
W78-07344 4A

### FLOODS

Methods for Calculating Maximum Flood  
Discharges for Natural Watercourses and  
Urban Areas in the U.S.S.R.,  
W78-07697 2A

### FLORIDA

Water-Column and Benthic Invertebrate and  
Plant Associations as Affected by the Physico-  
Chemical Aspects in a Mesotrophic Bayou  
Estuary Pensacola, Florida,  
W78-07203 5C

Uranium-Isotope Variations in Groundwaters  
of the Floridan Aquifer and Boulder Zone of  
South Florida,  
W78-07343 5B

### FLORIDAN AQUIFER

Uranium-Isotope Variations in Groundwaters  
of the Floridan Aquifer and Boulder Zone of  
South Florida,  
W78-07343 5B

### FLOW

Flow Monitoring Apparatus,  
W78-07236 5D

Orifice Effects on Oscillatory Flow,  
W78-07487 8B

Transient-And Steady-Flow Experiments Test-  
ing Theory of Water Flow in Saturated  
Bentonite,  
W78-07497 2G

### FLOW CHARACTERISTICS

Hydraulic Modeling of Mixing in Stratified  
Lakes,  
W78-07218 5B

### FLOW CONTROL

State Variable Model for Sewer Network Flow  
Routing,  
W78-07212 8B

Downstream-Upstream Reservoir Routing,  
W78-07344 4A

### FLOW MEASUREMENT

State Variable Model for Sewer Network Flow  
Routing,  
W78-07212 8B

Comparison of Numerical Simulation Flow  
Models for Coastal Inlets,  
W78-07472 2L

Design of Constant Accuracy Linear Propor-  
tional Weir,  
W78-07492 8B

### FLOW NETS

Seepage Study of the Sevier Valley-Piute  
Canal, Sevier County, Utah,  
W78-07360 4A

### FLOW PROFILES

State Variable Model for Sewer Network Flow  
Routing,  
W78-07212 8B

Water/Wastewater Survey Guidelines,  
W78-07522 5A

### FLOWMETERS

Wastewater System Provides New Water  
Source for St. Petersburg,  
W78-07432 5D

Vortex-Shedding Flowmeters,  
W78-07459 7B

### FOAM SEPARATION

The Recovery of Protein From Potato Juice  
Waste Water by Foam Separation,  
W78-07592 5D

### FOOD HABITS

Nearshore Fish and Macroinvertebrate Assem-  
blages Along the Strait of Juan de Fuca Includ-  
ing Food Habits of Nearshore Fish,  
W78-07543 2I

### FOOD PROCESSING INDUSTRY

Biological Purification of Sugar Works Waste  
Water--Includes Neutralization with Lime and  
Inoculation with *Chlorella* Culture Using  
Light and Carbon Dioxide,  
W78-07259 5D

Industrial Waste Management in the Dairy In-  
dustry in Poland,  
W78-07590 5D

Starch-Laden Effluent Treatment-A Case His-  
tory,  
W78-07591 5D

## FOOD PROCESSING INDUSTRY

The Recovery of Protein From Potato Juice  
Waste Water by Foam Separation,  
W78-07592 5D

Treatment of Some Industrial Effluents in  
Malaysia,  
W78-07602 5D

Mutant Bacteria Solve BOD Problem at Heat  
Packing Plant,  
W78-07603 5D

Industrial Sludge and Animal Slurry De-Water-  
ing,  
W78-07657 5D

## FORECASTING

Water Resources and Climatic Change,  
W78-07380 2A

## FOSSIL FUELS

Conserve Energy in Wastewater Systems,  
W78-07476 5D

## FOULING PLATES

An In Situ Study of Recruitment, Growth and  
Survival of Subtidal Marine Algae: Techniques  
and Preliminary Results,  
W78-07308 5C

## FRANCE

Urban Hydrological Modeling and Catchment  
Research in France,  
W78-07694 2A

## FRESHWATER MARSHES

Productivity of Red-Winged Blackbirds in  
Prairie Pothole Habitat,  
W78-07339 2I

## FROST

Dielectric Constant and Electroconductance of  
Some Dry Frost-Prone Soils,  
W78-07369 2C

## FUNGI

Taxonomic Studies on Aquatic Hyphomycetes,  
I. Lemonniera de Wildeman,  
W78-07271 5A

Microbial Interactions with Pesticides in  
Estuarine Surface Slicks,  
W78-07605 5C

Sewage Fungus Growth in Rivers Receiving  
Paper Mill Effluent,  
W78-07655 5C

## FURROW IRRIGATION

Effect of Irrigation Systems on Water Use Ef-  
ficiency and Soil Water Solute Concentrations,  
W78-07620 5G

## GALERKIN FINITE-ELEMENT TECHNIQUE

The Use of Galerkin Finite-Element Methods  
to Solve Mass-Transport Equations,  
W78-07354 5B

## GALVESTON HARBOR (TEX)

Physical Hydraulic Models: Assessment of Pre-  
dictive Capabilities: Report 2, Movable-Bed  
Model of Galveston Harbor Entrance,  
W78-07672 8B

## GAMMA RAYS

Gamma Ray Treatment Reaps Harvest from  
Sewage,  
W78-07333 5D

## GAS CHROMATOGRAPHY

Ratting Methods Applied to Gas Chromato-  
graphic Data for Oil Identification,  
W78-07269 5A

The Background to, and the Application of,  
Laboratory Instrumentation to Water Analysis,  
W78-07458 5A

## GASES

Gas Monitors for Sewage Treatment Works,  
W78-07454 5A

## GEOLOGIC INVESTIGATIONS

How to Meet Well Project Goals: Part I,  
W78-07581 4B

## GEOMORPHOLOGY

Flooding in Big Thompson River, Colorado.  
Tributaries: Controls on Channel Erosion and  
Estimates of Recurrence Interval,  
W78-07371 4D

Floodplain Delineation Using LANDSAT-1  
Data,  
W78-07510 4A

## GEORGIA BIGHT

The Results of Four Oceanographic Cruises in  
the Georgia Bight,  
W78-07537 2I

## GEOTHERMAL STUDIES

Hot Dry Rock Geothermal Energy Develop-  
ment Project: Annual Report, Fiscal Year 1977,  
W78-07572 8B

## GLACIOLOGY

North American Glacial History Extended to  
75,000 Years Ago,  
W78-07372 2C

## GONYAULAX POLYHEDRA

Marine Pollution Hazards,  
W78-07297 5C

## GOVERNMENT FINANCE

Alabama, (State Capital News),  
W78-07523 5D

## GRAND VALLEY (COLO)

The Hydro-Salinity System in the Grand Val-  
ley,  
W78-07647 5G

Modeling Salt Transport in the Irrigated Soils  
of Grand Valley,  
W78-07648 5B

Evaluating Appropriate Technologies for  
Salinity Control in Grand Valley,  
W78-07649 5G

Development of Best Management Practices  
for Salinity Control in Grand Valley,  
W78-07650 5G

## GRAVITY WAVES

Linear and Nonlinear Wave Action Estimates,  
W78-07485 2L

## GREASES

An Evaluation of Oil and Grease Contamina-  
tion Associated with Dredged Material Contain-  
ment Areas,  
W78-07681 5G

## GREAT LAKES REGION

North American Glacial History Extended to  
75,000 Years Ago,  
W78-07372 2C

## GROUNDWATER

Water Resources Data for Minnesota, Water  
Year 1976,  
W78-07313 7C

Water Resources Data for Arkansas, Water  
Year 1976,  
W78-07314 7C

Water Resources of the Weiser River Basin,  
West-Central Idaho,  
W78-07342 4A

Economic Impact of Water Quality on River  
Basin Management,  
W78-07396 5G

Practical Aspects of Water Litigation,  
W78-07413 6E

Two-Dimensional Plume in Uniform Ground-  
Water Flow,  
W78-07490 5B

Nonpoint Nitrate Contamination of Ground  
Water in Merrick County, Nebraska,  
W78-07506 5B

Nutrient, Bacterial, and Virus Control as Re-  
lated to Ground Water Contamination,  
W78-07571 5B

Formulating State Groundwater Policy in  
Pennsylvania,  
W78-07576 5G

Groundwater Tracing with Post Sampling Ac-  
tivation Analysis Using Bromide and Iodide  
Ions Injected Simultaneously into a Shallow-  
Well System,  
W78-07683 5B

## GROUNDWATER DATA SETS

Handbook-Index of Hawaii Groundwater and  
Resources Data, Extracted from Reports of the  
Water Resources Research Center, University  
of Hawaii, Volume I,  
W78-07395 7C

## GROUNDWATER MOUNDS

Artificial Ground-Water Recharge with Capil-  
larity,  
W78-07365 4B

## GROUNDWATER MOVEMENT

Uranium-Isotope Variations in Groundwaters  
of the Floridan Aquifer and Boulder Zone of  
South Florida,  
W78-07343 5B

Travel of Microorganisms from a Septic Tile,  
W78-07469 5B

## GROUNDWATER POTENTIAL

Hydrogeology of Metropolitan Christchurch,  
W78-07368 4B

## GROUNDWATER RECHARGE

Artificial Ground-Water Recharge with Capil-  
larity,  
W78-07365 4B

Porous Media Tests of Groundwater Mounds,  
W78-07387 2F

Groundwater Recharge and Coastal Discharge  
for the Northwest Coast of the Island of  
Hawaii: A Computerized Water Budget Ap-  
proach,  
W78-07394 2F

## GROUNDWATER RESOURCE

Relationship Between Groundwater Resources  
and Energy Production in Southwestern Mis-  
souri,  
W78-07202 2K



# SUBJECT INDEX

## HYDRAULIC CONDUCTIVITY

### GROUNDWATER RESOURCES

Availability and Quality of Ground Water in the Drain-Yoncalla Area, Douglas County, Oregon.  
W78-07347 7C

Preliminary Digital Model of the Arikaree Aquifer in the Sweetwater River Basin, Central Wyoming.  
W78-07351 2F

Water-Level Changes in Wells Along the West Side of the Cedar Creek Anticline, Southeastern Montana.  
W78-07357 4B

Description of Wells at Beale Air Force Base and Vicinity, California.  
W78-07358 4B

### GROUNDWATER SYSTEM

Impact of a Power Plant on the Ground-Water System of a Wetland.  
W78-07377 6G

### GROUNDWATER VELOCITY

Groundwater Tracing with Post Sampling Activation Analysis Using Bromide and Iodide Ions Injected Simultaneously into a Shallow-Well System.  
W78-07683 5B

### GROWTH RATES

A Test of the Effects of Domestic Sewage on the Growth of the Common Blue Mussel, *Mytilus Edulis*, in an Aquacultural System.  
W78-07205 5C

IBM 1130 Computation Process in the Study of Biophysical Constants Variations of Pathogenic Bacteria by Phytoplankton.  
W78-07264 5C

Temperature Requirements of Salmonids in Relation to Their Feeding, Bioenergetics, Growth and Behavior.  
W78-07322 5C

Trace Metal-Ohelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations.  
W78-07663 5C

Copper Sensitivity of *Gonyaulax Tamarensis*.  
W78-07664 5C

### GROWTH STAGES

A Comparative Study of the Effects of Mercuric Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, *Artemia Salina*.  
W78-07668 5C

### GYMNODINIUM BREVE

Marine Pollution Hazards.  
W78-07297 5C

### GYNOGENESIS

Production of Monosex White Amur for Aquatic Plant Control.  
W78-07326 4A

### HABITATS

Effects of Stream Channelization on Terrestrial Wildlife and Their Habitats in the Buena Vista Marsh, Wisconsin.  
W78-07228 6G

### HAIL

Variability of Hailstorms on the South African Plateau.  
W78-07507 2B

### HAM'S LAKE (OK)

Hydraulic Modeling of Mixing in Stratified Lakes.  
W78-07218 5B

### HARBORS

Inventory of Lake Ontario Inlets and Harbors: Niagara River to Stony Creek.  
W78-07225 2H

Environmental Management of a Ship Channel-Harbor Complex.  
W78-07539 5B

### HARVESTING OF ALGAE

Nuisance-Algae Control Through Mechanical Harvesting.  
W78-07266 5G

### HAWAII

Antecedent Event Influence on Benthic Marine Algal Standing Crops in Hawaii.  
W78-07295 2L

Rotating Disc Sewage Treatment Systems for Suburban Developments and High-Density Resorts of Hawaii.  
W78-07393 5D

Groundwater Recharge and Coastal Discharge for the Northwest Coast of the Island of Hawaii: A Computerized Water Budget Approach.  
W78-07394 2F

Handbook-Index of Hawaii Groundwater and Resources Data, Extracted from Reports of the Water Resources Research Center, University of Hawaii, Volume 1.  
W78-07395 7C

### HAWAII ISLAND

Groundwater Recharge and Coastal Discharge for the Northwest Coast of the Island of Hawaii: A Computerized Water Budget Approach.  
W78-07394 2F

### HEAT TRANSFER

Effect of Thermal Pretreatment on Digestibility and Dewaterability of Organic Sludges.  
W78-07457 5D

### HEAT TREATMENT

Heat Treatment and Pressing of Digested Sludge.  
W78-07437 5D

### HEATED WATER

Prediction of Temperature Due to Heated Discharges.  
W78-07495 5B

Model Study of Cool Water Discharge from Proposed LNG Facility, Los Angeles Harbor, California.  
W78-07669 5B

### HEAVY METALS

The Relationship of Lake Quality to Specific Urbanization Stresses.  
W78-07204 5C

A Study of Different Analytical Extraction Methods for Nondetril Heavy Metals in Aquatic Sediments.  
W78-07278 5A

Sedimentary Record of Heavy Metals and Polycyclic Aromatic Hydrocarbons in Lake Constance (In German).  
W78-07307 5B

Kinetic Studies on the Lime Sulfurated Solution (Calcium Polysulfide) Process for Removal of Heavy Metals from Waste Water.  
W78-07595 5D

A Preliminary Study of the Use of Benthic Algae as Biological Indicators of Heavy Metal Pollution in Solfjorden, Norway.  
W78-07665 5A

### HEPTACHLOR

Microbial Interactions with Pesticides in Estuarine Surface Slicks.  
W78-07605 5C

Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent.  
W78-07661 5C

### HERBICIDES

Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla.  
W78-07399 5G

Greenhouse Studies of the Growth and Reproduction of Egeria Densa.  
W78-07401 4A

Aquatic Weed Control in Small Reservoirs with Diquat.  
W78-07402 5G

### HIGH WATER MARK

Delineation of Tidal Wetlands Boundaries in Lower Chesapeake Bay and its Tributaries.  
W78-07229 2L

### HISTORY

North American Glacial History Extended to 75,000 Years Ago.  
W78-07372 2C

First Four Decades of the Hydraulics Division.  
W78-07382 2A

History of Sewage Pumping in Britain.  
W78-07417 8C

### HOOD CANAL

Evaluation of Water Quality of Puget Sound and Hood Canal in 1976.  
W78-07544 5C

### HOSPITALS

Medically Used Radionuclides in Sewage Sludge.  
W78-07460 5A

### HOT DRY ROCK

Hot Dry Rock Geothermal Energy Development Project: Annual Report, Fiscal Year 1977.  
W78-07572 8B

### HUMAN POPULATION

Sewage Dewatering Plant for Small Communities.  
W78-07660 5D

### HURRICANES

Suspended-Matter Distribution in the New York Bight Apex Related to Hurricane Belle.  
W78-07509 2L

### HURST PHENOMENON

Nonstationarity of the Mean and the Hurst Phenomenon.  
W78-07388 2E

### HYDRAULIC CONDUCTIVITY

Effects of Clay Type and Content, Exchangeable Sodium Percentage, and Electrolyte Con-

# SUBJECT INDEX

## HYDRAULIC CONDUCTIVITY

centration on Clay Dispersion and Soil Hydraulic Conductivity, W78-07498 2G

Groundwater Tracing with Post Sampling Activation Analysis Using Bromide and Iodide Ions Injected Simultaneously into a Shallow-Well System, W78-07683 5B

## HYDRAULIC FRACTURING

Hot Dry Rock Geothermal Energy Development Project: Annual Report, Fiscal Year 1977, W78-07572 8B

## HYDRAULIC JUMP

Drag on Baffle Walls in Hydraulic Jump, W78-07491 8B

## HYDRAULIC MODELS

Hydraulic Modeling of Mixing in Stratified Lakes, W78-07218 5B

Hydraulics of Sheet Flow in Wetlands, W78-07340 8B

Model Study of Cool Water Discharge from Proposed LNG Facility, Los Angeles Harbor, California, W78-07669 5B

Dispersion of Proposed Effluent Discharges and Saltwater Intrusion in Cooper River; Hydraulic Model Investigation, W78-07670 5B

Improvements for Little River Inlet, South Carolina; Hydraulic Model Investigation, W78-07671 8B

Physical Hydraulic Models: Assessment of Predictive Capabilities; Report 2. Movable-Bed Model of Galveston Harbor Entrance, W78-07672 8B

## HYDRAULIC POWER

Identification of Alternative Power Sources for Dredged Material Processing Operations, W78-07680 8C

## HYDRAULIC STRUCTURES

The Use of Filterbelt Presses for Dewatering of Sewage Sludges, W78-07426 5D

## HYDRAULICS

First Four Decades of the Hydraulics Division, W78-07382 2A

Linear and Nonlinear Wave Action Estimates, W78-07485 2L

Free Surface Flow Computations by Characteristics, W78-07493 2E

## HYDRILLA VERTICILLATA

Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, W78-07399 5G

Efficacy and Residues of Diquat Applied for Control of Egeria and Hydrilla, W78-07400 5G

## HYDRODYNAMICS

Development of a Two Dimensional Hydrodynamic Numerical Model for Use in a Shallow, Well-Mixed Estuary, W78-07408 2L

Linear and Nonlinear Wave Action Estimates, W78-07485 2L

## HYDROGEN

Odor and Corrosion Control, W78-07430 5D

## HYDROGEN ION CONCENTRATION

pH Averaging, W78-07456 5A

Factors Involved in the Resistance of Brook Trout to Sulfuric Acid Solutions and Mine Acid Polluted Waters, W78-07684 5C

## HYDROGEN SULFIDE

Ozone in the Treatment of Odors from Sewage Works, W78-07434 5D

New Procedure Determines Aerobic Sludge Stability, W78-07464 5D

## HYDROGEOLOGY

Hydrogeology of Metropolitan Christchurch, W78-07368 4B

## HYDROGRAPH ANALYSIS

S-Hydrographs and Change of Unit Hydrograph Duration, W78-07385 2A

## HYDROGRAPH DURATION

S-Hydrographs and Change of Unit Hydrograph Duration, W78-07385 2A

## HYDROGRAPHIC SURVEYS

The 1973 Bathymetric Survey in the New York Bight Apex: Maps and Geological Implications, W78-07548 2L

Positioning Techniques and Equipment for U. S. Army Corps of Engineers Hydrographic Surveys, W78-07676 7B

## HYDROLOGIC ASPECTS

U.S. IFYGL Ship System: Description of Archived Data, W78-07554 2H

Urban Hydrological Modeling and Catchment Research in India, W78-07690 2A

## HYDROLOGIC BUDGET

Transformation of the Hydrologic Budget of the Moscow City Area, W78-07376 4C

Urban Hydrological Modeling and Catchment Research in Sweden, W78-07695 2A

## HYDROLOGIC DATA

Water Resources Data for Minnesota, Water Year 1976, W78-07313 7C

Water Resources Data for Arkansas, Water Year 1976, W78-07314 7C

Availability and Quality of Ground Water in the Drain-Yoncalla Area, Douglas County, Oregon, W78-07347 7C

Seepage Study of the Sevier Valley-Piute Canal, Sevier County, Utah, W78-07360 4A

Generation of Ungaged Streamflow Data, W78-07384 2A

## HYDROLOGICAL EXTREMES

Some Properties of Variance Reduction Techniques Where Hydrological Extremes Are Estimated by Monte Carlo Simulation, W78-07391 2E

## HYDROLOGY

Urban Runoff Research in Poland, W78-07691 2A

Methods for Calculating Maximum Flood Discharges for Natural Watercourses and Urban Areas in the U.S.S.R., W78-07697 2A

Urban Hydrological Modeling and Catchment Research in the United Kingdom, W78-07698 2A

Urban Hydrological Modeling and Catchment Research in Australia, W78-07699 2A

Urban Hydrological Modeling and Catchment Research in the U.S.A., W78-07700 2A

## HYDROLYSIS

Solubilization of Organic Carbon During the Acid Phase of Anaerobic Digestion, W78-07518 5D

## HYDROPHYTES

An Analytical Evaluation of the Utilization and Management of Water Resources in the Lake Metigoshe Watershed, North Dakota, W78-07209 5C

## HYPHOMYCETES

Taxonomic Studies on Aquatic Hyphomycetes, I. Lemmoniera de Wildeman, W78-07271 5A

## HYSTERESIS EFFECT

Variation of Drainage Density in a Small British Columbia Watershed, W78-07505 4D

## ICE

Visual Observations of Floating Ice from Skylab, W78-07346 2C

## IDAHO

An Attempt to Quantify the Esthetics of Wild and Scenic Rivers in Idaho, W78-07220 6B

Water Resources of the Weiser River Basin, West-Central Idaho, W78-07342 4A

On-Farm Method for Controlling Sediment and Nutrient Losses, W78-07626 5G

Economic Analysis of On-Farm Methods for Controlling Sediment and Nutrient Losses, W78-07627 5G

## ILLINOIS

Technique for Estimating Magnitude and Frequency of Floods in Illinois, W78-07350 4A

Frequency Analysis of Illinois Floods Using Observed and Synthetic Streamflow Records, W78-07355 4A

## IMPOUNDMENTS

The Effects of Diurnal Mixing on Thermal Stratification of Static Impoundments, W78-07210 2H

# SUBJECT INDEX

## INVERTEBRATES

West Point Lake Postimpoundment Study,  
W78-07287 5C

## INCINERATION

Adsorption of Textile Dyes by Activated Carbon Produced from Agricultural, Municipal and Industrial Wastes,  
W78-07599 5D

## INDEXING

Index of Surface-Water Stations in Texas, October 1977,  
W78-07312 7C

## INDIA

Urban Hydrological Modeling and Catchment Research in India,  
W78-07690 2A

## INDICATORS

Total Organic Halogen as Water Quality Parameter: Adsorption/Microcoulometric Method,  
W78-07273 5A

Determination of Total Organic Carbon in Potable Water, Sewage, Industrial Effluents, and Boiler Feed Water,  
W78-07404 5A

Use of Benthic Sediments as Indicators of Marina Flushing,  
W78-07553 5A

## INDUSTRIAL WASTES

Preliminary Tests of the Influence of Waste Waters from Sugar Factories on the Numbers of Intestinal Bacteria in Water (In German),  
W78-07223 5C

Method for Purification of Industrial Waste Water,  
W78-07247 5D

Process for Treating Wool Scouring Wastes,  
W78-07249 5D

Industrial Wastes, MESA New York Bight Atlas Monograph 30,  
W78-07547 5B

Photographic Processing Effluent Control,  
W78-07588 5D

Ozonation of Coal Gasification Plant Wastewater,  
W78-07589 5A

Industrial Sludge and Animal Slurry De-Watering,  
W78-07657 5D

## INFILTRATION

Effects of Wetting Agents on Water Infiltration into Water-Repellent Coal Mine Spoils,  
W78-07370 5G

Steady-State Solute Convection in Two Dimensions with Nonuniform Infiltration,  
W78-07381 2G

Reclamation of Wastewater by Application on Land,  
W78-07519 5D

## INFILTRMETERS

Monitoring in the Zone of Aeration,  
W78-07470 5A

## INFILUENT STREAMS

The Behavior of F2 Coliphage in Activated Sludge Treatment,  
W78-07461 5D

## INFORMATION EXCHANGE

Handbook-Index of Hawaii Groundwater and Resources Data. Extracted from Reports of the Water Resources Research Center, University of Hawaii, Volume 1,  
W78-07395 7C

## INFRARED

Appendix E to Correlation of Dual-Channel Airborne IR Data with Soil Moisture Measurements,  
W78-07383 2G

## INFRARED RADIATION

The Background to, and the Application of, Laboratory Instrumentation to Water Analysis,  
W78-07458 5A

Measuring Petroleum Hydrocarbons in Digested Sewage Sludges,  
W78-07462 5A

## INJECTION WELLS

Groundwater Tracing with Post Sampling Activation Analysis Using Bromide and Iodide Ions Injected Simultaneously into a Shallow-Well System,  
W78-07683 5B

## INLAND DISPOSAL SITES

Feasibility of Inland Disposal of Dewatered Dredged Material: A Literature Review,  
W78-07682 5E

## INLAND WATERWAYS

Environmental Considerations Relating to Operation and Maintenance of the Texas Gulf Intracoastal Waterway,  
W78-07538 2L

## INLETS (WATERWAYS)

Inventory of Lake Ontario Inlets and Harbors: Niagara River to Stony Creek,  
W78-07225 2H

Comparison of Numerical Simulation Flow Models for Coastal Inlets,  
W78-07472 2L

## INSPECTION

Grouting Provides Economical and Effective Maintenance in Kansas,  
W78-07421 8G

## INSTITUTIONAL CONSTRAINTS

Instream Flow Decision-Making in the Pacific Northwest,  
W78-07480 6E

## INSTITUTIONS

A Process for Identifying, Evaluating and Implementing Solutions for Irrigation Return Flow Problems,  
W78-07654 5G

## INSTREAM FLOW

Instream Flow Decision-Making in the Pacific Northwest,  
W78-07480 6E

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Executive Summary),  
W78-07563 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Executive Summary),  
W78-07564 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish Wildlife, Part B: California (Final Report),  
W78-07565 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Case Studies),  
W78-07566 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Final Report),  
W78-07567 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Rocky Mountain Region Case Studies),  
W78-07568 6G

## INSTRUMENTATION

Wastewater System Provides New Water Source for St. Petersburg,  
W78-07432 5D

Sewage Sludge Lime Dosing and Filter Press Feeding,  
W78-07438 5D

Chlorine Detector Saves a Life,  
W78-07453 5A

Gas Monitors for Sewage Treatment Works,  
W78-07454 5A

The Background to, and the Application of, Laboratory Instrumentation to Water Analysis,  
W78-07458 5A

Vortex-Shedding Flowmeters,  
W78-07459 7B

Multiple Tensiometer Flushing System,  
W78-07499 2G

Sampling of Water and Wastewater,  
W78-07517 5A

Instrumentation and Automation in Water and Wastewater Treatment,  
W78-07525 5A

## INTAKES

Model Tests of Circular Sewage Sedimentation Tanks,  
W78-07468 5D

Sewage System Rejuvenation,  
W78-07535 8G

## INTERNATIONAL HYDROLOGICAL PROGRAMME

Urban Hydrological Modeling and Catchment Research in India,  
W78-07690 2A

## INTERSTATE COMPACT

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1977 Water Year,  
W78-07345 4A

## INTERTIDAL AREAS

Plant Species Diversity in a Marine Intertidal Community: Importance of Herbivore Food Preference and Algal Competitive Abilities,  
W78-07341 2L

## INVERTEBRATES

The Utilization of Dissolved Organic Compounds in Aquatic Environments,  
W78-07296 5C



# SUBJECT INDEX

## INVERTEBRATES

Nearshore Fish and Macroinvertebrate Assemblages Along the Strait of Juan de Fuca Including Food Habits of Nearshore Fish.  
W78-07543 2L

## IODIDES

Groundwater Tracing with Post Sampling Activation Analysis Using Bromide and Iodide Ions Injected Simultaneously into a Shallow-Well System.  
W78-07683 5B

## IODINE

Apparatus for Purifying Water.  
W78-07251 5F

A Test and a Technique for Predicting BOD5 Values of Kraft Mill Waste.  
W78-07597 5A

## IODINE RADIOISOTOPES

Medically Used Radionuclides in Sewage Sludge.  
W78-07460 5A

## ION EXCHANGE

Removal of Chromium Anions from Industrial Effluents--By Contacting with Particles of Insoluble Lead CPD Adsorbed on Particulate Insoluble Carrier.  
W78-07256 5D

A New Dialysis-Ion Exchange Technique for Determining the Forms of Trace Metals in Water.  
W78-07277 5A

Copper Sensitivity of Gonyaulax Tamarensis.  
W78-07664 5C

## IONS

The Effect of the Ionic Composition of the Environment on Oxygen Exchange in the Alga Acetabularia (In Russian).  
W78-07213 5C

Trace Metal-Ohelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations.  
W78-07663 5C

Copper Sensitivity of Gonyaulax Tamarensis.  
W78-07664 5C

## IOWA

Flood Damages on the Iowa River.  
W78-07258 4A

Mississippi River Basin Sterol Assay Project Report. Coprostanol, A Positive Molecular Marker of Domestic and Run-Off Sewage, Wastewater Plant Effluent and Surface Waters in the Burlington, Iowa Area on the Mississippi River.  
W78-07329 5A

Analysis of Various Iowa Waters for Selected Pesticides: Atrazine, DDE, and Dieldrin--1974.  
W78-07331 5A

Productivity of Red-Winged Blackbirds in Prairie Pothole Habitat.  
W78-07339 2I

## IOWA HYDRAULICS CONFERENCE

First Four Decades of the Hydraulics Division.  
W78-07382 2A

## IOWA RIVER

Flood Damages on the Iowa River.  
W78-07258 4A

## IRON

Ductile-Iron Pipe Gallery.  
W78-07416 8G

Phosphorus Removal by Precipitation with FE (III).  
W78-07465 5D

Process Design Manual for Phosphorus Removal.  
W78-07527 5D

Cross-Flow Filtration in Physical-Chemical Treatment of Municipal Sewage Effluents.  
W78-07533 5D

Trace Metal-Ohelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations.  
W78-07663 5C

## IRON EXCHANGE

Clinoptilolite Column Ammonia Removal Model.  
W78-07466 5D

## IRRADIATION

Gamma Ray Treatment Reaps Harvest from Sewage.  
W78-07333 5D

## IRRIGATION

Irrigation Gravel Guard.  
W78-07235 3F

Aeration Tube.  
W78-07237 3F

Self Cleaning, Pressure Responsive Emitter Valve for Soil Irrigation.  
W78-07243 3F

Traveling Sprinkler Guide Wheel Assembly.  
W78-07244 3F

Irrigation Water Supply Study for Red Prairie Irrigation District, Polk and Yamhill Counties, Oregon.  
W78-07282 3F

Economic Impact of Water Quality on River Basin Management.  
W78-07396 5G

How the NPDES Program Will Define Present Water Quality Conditions.  
W78-07637 5G

The '208' Planning Effort for Irrigated Agriculture in the State of Washington.  
W78-07642 5G

Interface of Water Quantity and Quality Laws in the West.  
W78-07652 6E

An Influent Control Approach to Irrigation Return Flow Quality Management.  
W78-07653 5G

## IRRIGATION EFFECTS

Economic and Agronomic Effects of High Irrigation Levels on Alfalfa and Barley.  
W78-07397 3F

Western Kansas Faces Declining Water Table.  
W78-07583 4B

## IRRIGATION EFFICIENCIES

An Assessment of Irrigation Efficiencies and Drainage Return Flows from the Wellton-Mohawk Division of the Gila Project.  
W78-07644 3C

## IRRIGATION EFFICIENCY

Irrigation Gravel Guard.  
W78-07235 3F

Aeration Tube.  
W78-07237 3F

Moisture Sensing Apparatus and Method.  
W78-07242 3F

Self Cleaning, Pressure Responsive Emitter Valve for Soil Irrigation.  
W78-07243 3F

Effects of Irrigation Management on Soil Salinity and Return Flow Quality.  
W78-07619 5G

Scientific Irrigation Scheduling for Salinity Control of Irrigation Return Flow.  
W78-07621 5G

Water Distribution Patterns for Sprinkler and Surface Irrigation Systems.  
W78-07631 3F

Application of Modern Irrigation Technology in the Mesilla Valley, New Mexico.  
W78-07634 3C

Wellton-Mohawk On-Farm Systems Improvement Program.  
W78-07645 3C

## IRRIGATION PRACTICES

Self Cleaning, Pressure Responsive Emitter Valve for Soil Irrigation.  
W78-07243 3F

Economic and Agronomic Effects of High Irrigation Levels on Alfalfa and Barley.  
W78-07397 3F

Reclamation of Wastewater by Application on Land.  
W78-07519 5D

Proceedings of National Conference: Irrigation Return Flow Quality Management.  
W78-07606 5G

## IRRIGATION SYSTEMS

Aeration Tube.  
W78-07237 3F

Moisture Sensing Apparatus and Method.  
W78-07242 3F

Proceedings of National Conference: Irrigation Return Flow Quality Management.  
W78-07606 5G

Effect of Three Irrigation Systems on Distribution of Fertilizer Nitrate Nitrogen in Soil.  
W78-07610 5B

## IRRIGATION WATER

Wastewater Effluent Line Serves Dual Purpose.  
W78-07419 5E

Scientific Irrigation Scheduling for Salinity Control of Irrigation Return Flow.  
W78-07621 5G

Quality of Irrigation Return Flow from Flooded Rice Paddies.  
W78-07623 5B

## JETS

Forced Plumes in a Stratified Reservoir.  
W78-07489 8B

# SUBJECT INDEX

## LIGANDS

- KANSAS**  
Western Kansas Faces Declining Water Table.  
W78-07583 4B
- KIEV RESERVOIR (U.S.S.R.)**  
Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters,  
W78-07294 5C
- KINETICS**  
Nitrification and Nitrogen Removal,  
W78-07215 5D
- Characterization of Sulphate Uptake in *Anacystis Nidulans*,  
W78-07304 5C
- KOLYMA HYDROELECTRIC POWERPLANT (USSR)**  
Dam of the Kolyma Hydroelectric Power Plant,  
W78-07511 8D
- KRASNOYARSK AREA (USSR)**  
Analysis of Intense Precipitation in the Krasnoyarsk Area,  
W78-07374 2B
- LAKE BASINS**  
Hydrological Studies on a Small Basin on the Canadian Shield.  
W78-07406 2H
- LAKE CHAMPLAIN**  
Sediment Thicknesses, Eastern Lake Champlain,  
W78-07686 2J
- LAKE CONSTANCE (WEST GERMANY)**  
Sedimentary Record of Heavy Metals and Polycyclic Aromatic Hydrocarbons in Lake Constance (In German),  
W78-07307 5B
- LAKE METIGOSHE WATERSHED (N DAK)**  
An Analytical Evaluation of the Utilization and Management of Water Resources in the Lake Metigoshe Watershed, North Dakota,  
W78-07209 5C
- LAKE ONEGA (USSR)**  
Dynamics of Lake Onega Waters,  
W78-07501 2H
- LAKE ONTARIO**  
Inventory of Lake Ontario Inlets and Harbors: Niagara River to Stony Creek,  
W78-07225 2H
- Prediction of Temperature Due to Heated Discharges,  
W78-07495 5B
- U.S. IFYGL Ship System: Description of Archived Data,  
W78-07554 2H
- LAKE PONTCHARTRAIN (LA)**  
The Impact of the 1975 Bonnet Carré Spillway Opening on Epifaunal Invertebrates in Southern Lake Pontchartrain,  
W78-07219 5C
- LAKE QARUN (EGYPT)**  
The Problem of the Salinity Increase in Lake Qarun (Egypt) and a Proposed Solution,  
W78-07305 5C
- LAKE SCHOEHSEE (WEST GERMANY)**  
Stable Nitrogen-Containing Dissolved Organic Substance in Lake Schoehsee and in Cultures of Algae (In German),  
W78-07260 5B
- LAKE SEDIMENTS**  
Sediment Thicknesses, Eastern Lake Champlain,  
W78-07686 2J
- LAKE TAHOE (CA NV)**  
The Relation Between Adenosine Triphosphate and Microbial Biomass in Diverse Aquatic Ecosystems,  
W78-07306 5C
- LAKE WINNIPESAUKEE (NH)**  
Distribution, Growth, and Phosphorus Relationships of *Myriophyllum heterophyllum* Michx. in Lake Winnepesaukee, New Hampshire,  
W78-07482 5C
- LAKES**  
The Relationship of Lake Quality to Specific Urbanization Stresses,  
W78-07204 5C
- Make Wastewater More Versatile: Reuse it for Recreation Lakes,  
W78-07217 5D
- Nitrogen Transformation in Lakes,  
W78-07262 5C
- Hydrological Studies on a Small Basin on the Canadian Shield.  
W78-07406 2H
- Dynamics of Lake Onega Waters,  
W78-07501 2H
- LAND USE**  
Planning Guidelines for Residential and Path Development in Michigan's Sand Dunes and Wetlands.  
W78-07227 4A
- Land Use and Pollution Patterns on the Great Lakes,  
W78-07288 5B
- The National Land Use Data Program of the U.S. Geological Survey,  
W78-07316 4A
- Land Use and Environmental Assessment in the Central Atlantic Region,  
W78-07317 4A
- Effect of the Small Watershed Program on Major Uses of Land: Examination of 60 Projects in the Southeast, Mississippi Delta, and Missouri River Tributaries Regions,  
W78-07330 4D
- Environmental Considerations Relating to Operation and Maintenance of the Texas Gulf Intracoastal Waterway,  
W78-07538 2L
- LAND USE DATA AND ANALYSIS PROGRAM (LUDA)**  
The National Land Use Data Program of the U.S. Geological Survey,  
W78-07316 4A
- LANDSATS**  
The South Dakota Cooperative Land Use Effort: A State Level Remote Sensing Demonstration Project,  
W78-07315 4A
- The National Land Use Data Program of the U.S. Geological Survey,  
W78-07316 4A
- Land Use and Environmental Assessment in the Central Atlantic Region.  
W78-07317 4A
- LANDSAT-1**  
Floodplain Delineation Using LANDSAT-1 Data,  
W78-07510 4A
- LEACHING**  
Rate of Ammonium Nitrification and Nitrate Leaching in Soil Columns,  
W78-07520 5B
- Variability of Nitrate Leaching Within Defined Management Units,  
W78-07612 5B
- LEAD**  
Removal of Chromium Anions from Industrial Effluents--By Contacting with Particles of Insoluble Lead CPD Adsorbed on Particulate Insoluble Carrier.  
W78-07256 5D
- A Preliminary Study of the Use of Benthic Algae as Biological Indicators of Heavy Metal Pollution in Sorfjorden, Norway.  
W78-07665 5A
- LEAKAGE**  
Flow to a Nonpenetrating Well in a Leaky Artesian Aquifer with Variable Discharge,  
W78-07378 2F
- Grouting Provides Economical and Effective Maintenance in Kansas,  
W78-07421 8G
- LEAKY AQUIFERS**  
Flow to a Nonpenetrating Well in a Leaky Artesian Aquifer with Variable Discharge,  
W78-07378 2F
- LEGAL ASPECTS**  
Practical Aspects of Water Litigation,  
W78-07413 6E
- LEGISLATION**  
Modernization and Improvement of New York's Riparian Law,  
W78-07410 6E
- Technical and Philosophical Aspects of Ocean Disposal,  
W78-07540 5E
- LEMONNIERA**  
Taxonomic Studies on Aquatic Hyphomycetes. I. *Lemonniera de Wildeman*,  
W78-07271 5A
- LICENSING**  
State Agencies and Officials Responsible for Water Well Industry Codes and Licensing.  
W78-07573 6E
- Water Well Industry Codes and Licensing.  
W78-07574 6E
- LIFE CYCLES**  
COPEPOD4: A Discrete Time-Delay Model of Copepod Population Dynamics,  
W78-07289 5B
- LIGANDS**  
Trace Metal-Ohelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations,  
W78-07663 5C

# SUBJECT INDEX

## LIGHT

### LIGHT

Biological Purification of Sugar Works Waste Water-Includes Neutralization with Lime and Inoculation with *Chlorella* Culture Using Light and Carbon Dioxide.  
W78-07259 5D

Antecedent Event Influence on Benthic Marine Algal Standing Crops in Hawaii.  
W78-07295 2L

### LIGHT INTENSITY

Anaerobic ATP Levels in the Blue-Green Alga *Anabaena*: Dark-Light Transients and Effects of Light Intensity.  
W78-07303 5C

### LIGNITE POWER PLANT

Determination of Trace Elements in the English Coulee System: Presence Due to Extended Lignite Burning.  
W78-07208 5A

### LIME

Biological Purification of Sugar Works Waste Water-Includes Neutralization with Lime and Inoculation with *Chlorella* Culture Using Light and Carbon Dioxide.  
W78-07259 5D

Sewage Sludge Lime Dosing and Filter Press Feeding.  
W78-07438 5D

Process Design Manual for Phosphorus Removal.  
W78-07527 5D

### LIMITING FACTORS

Physical-Chemical Methods for the Control of Algal Species and Composition in Algal Culturing Facilities.  
W78-07324 5G

### LINDANE

A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem.  
W78-07667 5A

### LINEAR PROPORTIONAL WEIRS

Design of Constant Accuracy Linear Proportional Weir.  
W78-07492 8B

### LINED

Lined: A One Dimensional Multireach Sediment Transport Model.  
W78-07363 2J

### LIPIDS

Measuring Petroleum Hydrocarbons in Digested Sewage Sludges.  
W78-07462 5A

### LIQUID WASTES

Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent.  
W78-07655 5C

### LITERATURE REVIEWS

Feasibility of Inland Disposal of Dewatered Dredged Material: A Literature Review.  
W78-07682 5H

### LITTLE RIVER INLET (SC)

Improvements for Little River Inlet, South Carolina: Hydraulic Model Investigation.  
W78-07671 8B

### LITTORAL

Photorespiration in Larger Littoral Algae.  
W78-07274 5C

## SU-22

### LOAM

Reclamation of Wastewater by Application on Land.  
W78-07519 5D

### LONG ISLAND SOUND

Nutrient Distributions and Transport in Long Island Sound.  
W78-07550 5B

### LOS ANGELES (CA)

Marine Pollution Hazards.  
W78-07297 5C

### LOS ANGELES HARBOR (CALIF)

Model Study of Cool Water Discharge from Proposed LNG Facility, Los Angeles Harbor, California.  
W78-07669 5B

### LOUISIANA

The Impact of the 1975 Bonnet Carré Spillway Opening on Epifaunal Invertebrates in Southern Lake Pontchartrain.  
W78-07219 5C

### LOWER MIDWAY ESTUARY

Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Midway Estuary, Kent.  
W78-07661 5C

### LOWER ST. REGIS LAKE (NY)

Restoration of Lower St. Regis Lake (Franklin County, New York).  
W78-07291 5G

### LUCERNE LAKE (CALIF)

Flood-Hazard Study--100-Year Flood Stage for Lucerne Lake, San Bernardino County, California.  
W78-07359 4A

### LYSIMETERS

Monitoring in the Zone of Aeration.  
W78-07470 5A

### MACROBENTHOS

Macrobenthos of the Tidal Delaware River Between Trenton and Burlington, New Jersey.  
W78-07300 5C

### MAKEUP WATER

Make Wastewater More Versatile: Reuse it for Recreation Lakes.  
W78-07217 5D

### MALAYSIA

Treatment of Some Industrial Effluents in Malaysia.  
W78-07602 5D

### MANAGEMENT

Innovative Management Concept for 208 Planning.  
W78-07222 5G

Environmental Considerations Relating to Operation and Maintenance of the Texas Gulf Intracoastal Waterway.  
W78-07538 2L

### MANGANESE

Role of Plankton in the Behavior of TC99 and MN54 in Seawater.  
W78-07286 5C

### MANNINGS EQUATION

Hydraulics of Sheet Flow in Wetlands.  
W78-07340 8B

### MANPOWER

NWWA's Most Requested Statistics.  
W78-07582 8A

### MAPPING

The National Land Use Data Program of the U.S. Geological Survey.  
W78-07316 4A

Floodplain Delineation Using LANDSAT Data.  
W78-07510 4A

### MAPS

Availability and Quality of Ground Water in the Drain-Yoncalla Area, Douglas County, Oregon.  
W78-07347 7C

The 1973 Bathymetric Survey in the New York Bight Apex: Maps and Geological Implications.  
W78-07548 2L

### MARINAS

Use of Benthic Sediments as Indicators of Marina Flushing.  
W78-07553 5A

### MARINE ALGAE

Antecedent Event Influence on Benthic Marine Algal Standing Crops in Hawaii.  
W78-07295 2L

An In Situ Study of Recruitment, Growth and Survival of Subtidal Marine Algae: Techniques and Preliminary Results.  
W78-07308 5C

Trace Metal-Ohelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations.  
W78-07663 5C

A Preliminary Study of the Use of Benthic Algae as Biological Indicators of Heavy Metal Pollution in Sørjorden, Norway.  
W78-07665 5A

### MARINE BACTERIA

Microbial Interactions with Pesticides in Estuarine Surface Slicks.  
W78-07605 5C

### MARSH MANAGEMENT

City of Newport News and Fort Eustis Tidal Marsh Inventory.  
W78-07224 2L

### MARSH PLANTS

Shoreline Plant Establishment and Use of a Wave-Stilling Device.  
W78-07230 2L

Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland.  
W78-07279 5C

### MARSHES

Data Report--Marsh/Pond System.  
W78-07338 5D

Natural Sewage Recycling Systems  
W78-07515 5D

### MASONBORO INLET (NC)

Comparison of Numerical Simulation Flow Models for Coastal Inlets.  
W78-07472 2L

### MATHEMATICAL MODELS

State Variable Model for Sewer Network Flow Routing.  
W78-07212 8B

### Nitrification

W78-07215 8A

### Summary R

W78-07318

### Unsteady-S

W78-07348

### Lined: A

ment Trans  
W78-07363

### Flow to a

tesian Aqu  
W78-07378

### Dispersion

ry Condi  
W78-07386

### Nonstation

Phenomen  
W78-07388

### A Variati

Free Surf  
W78-07396

### Some Pr

Technique  
Estimated  
W78-07399

### The Dishe

Modeling  
W78-07399

### Developm

Hydrodyn  
Shallow.  
W78-07400

### Steric Hi

in Activ  
Solution  
Treated S  
W78-07405

### Developm

for Sewa  
W78-07405

### Compari

Models f  
W78-07405

### Impleme

by Mean  
Applied  
W78-07405

### Capacity

Treatme  
W78-07405

### Generat

for Na  
Model.  
W78-07405

### Dye Wa

W78-07405

### Nearsho

Simulat  
W78-07405

### An Ener

W78-07405



# SUBJECT INDEX

# METHOD OF CHARACTERISTICS

Nitrification and Nitrogen Removal,  
W78-07215 5D

Summary Report - The Chowan River Project,  
W78-07318 5C

Unsteady-State Water-Quality Model,  
W78-07348 5B

Lined: A One Dimensional Multireach Sediment Transport Model,  
W78-07363 2J

Flow to a Nonpenetrating Well in a Leaky Artesian Aquifer with Variable Discharge,  
W78-07378 2F

Dispersion in Soil Columns: Effect of Boundary Conditions and Irreversible Reactions,  
W78-07386 2G

Nonstationarity of the Mean and the Hurst Phenomenon,  
W78-07388 2E

A Variational Inequality Method Applied to Free Surface Seepage from a Triangular Ditch,  
W78-07390 4A

Some Properties of Variance Reduction Techniques Where Hydrological Extremes Are Estimated by Monte Carlo Simulation,  
W78-07391 2F

The Dishonest Method in Stream Temperature Modeling,  
W78-07392 2D

Development of a Two Dimensional Hydrodynamic Numerical Model for Use in a Shallow, Well-Mixed Estuary,  
W78-07408 2L

Steric Hindrance on Competitive Interaction in Activated Carbon Adsorption from BI-Solute Solution of Phenol and Organics in Biological Treated Sewage, (In Japanese),  
W78-07455 5D

Developments in Performance Relationships for Sewage,  
W78-07467 5D

Comparison of Numerical Simulation Flow Models for Coastal Inlets,  
W78-07472 2L

Implementing Cost-Effective Pollution Control by Means of Effluent Charges: An Example Applied to Electroplating Discharges,  
W78-07481 5G

Capacity Planning for Regional Wastewater Treatment Systems,  
W78-07521 5D

Generation of Tidal Current and Height Charts for Narragansett Bay Using a Numerical Model,  
W78-07555 2L

Dye Waste Treatment and Reuse,  
W78-07600 5D

Nearshore Numerical Storm Surge and Tidal Simulation,  
W78-07679 8B

An Energy Model of Pennsylvania,  
W78-07685 6A

## MATHEMATICAL STUDIES

Theory and Numerical Analysis of Moving Boundary Problems in the Hydrodynamics of Porous Media,  
W78-07389 2F

## MATHEMATICS

Free Surface Flow Computations by Characteristics,  
W78-07493 2E

## MEASUREMENT

Oil Pollution Monitoring and Monitoring Unit,  
W78-07234 5A

Flow Monitoring Apparatus,  
W78-07236 5D

A New Dialysis-Ion Exchange Technique for Determining the Forms of Trace Metals in Water,  
W78-07277 5A

Salinity: Its Definition and Calculation,  
W78-07367 2K

Appendix E to Correlation of Dual-Channel Airborne IR Data with Soil Moisture Measurements,  
W78-07383 2G

Determination of Total Organic Carbon in Potable Water, Sewage, Industrial Effluents, and Boiler Feed Water,  
W78-07404 5A

Wastewater System Provides New Water Source for St. Petersburg,  
W78-07432 5D

Gas Monitors for Sewage Treatment Works,  
W78-07454 5A

Vortex-Shedding Flowmeters,  
W78-07459 7B

A Simple Laboratory Apparatus to Measure Relative Erodibility of Soils,  
W78-07504 2J

Sampling of Water and Wastewater,  
W78-07517 5A

Water/Wastewater Survey Guidelines,  
W78-07522 5A

Instrumentation and Automation in Water and Wastewater Treatment,  
W78-07525 5A

## MECHANICAL CONTROL

Nuisance-Algae Control Through Mechanical Harvesting,  
W78-07266 5G

Physical-Chemical Methods for the Control of Algal Species and Composition in Algal Culturing Facilities,  
W78-07324 5G

## MELTING

Arrestment of Fumes in the Non-Ferrous Metals Industry,  
W78-07596 5G

## MEMBRANE PROCESSES

Filter Sack Dewatering,  
W78-07429 5D

Trace Metal-Ohelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations,  
W78-07663 5C

## MERCURY

Mercury Pollution of Water (In Bulgarian),  
W78-07268 5B

A Comparative Study of the Effects of Mercuric Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, *Artemia Salina*,  
W78-07668 5C

## MESILLA VALLEY (NMEX)

Application of Modern Irrigation Technology in the Mesilla Valley, New Mexico,  
W78-07634 3C

Economics of Controlling Irrigation Return Flow in the Mesilla Valley, New Mexico,  
W78-07635 5G

## MESOTROPHY

Water-Column and Benthic Invertebrate and Plant Associations as Affected by the Physico-Chemical Aspects in a Mesotrophic Bayou Estuary Pensacola, Florida,  
W78-07203 5C

## METABOLISM

Characterization of Sulphate Uptake in *Anaerobaculum* *Nidulans*,  
W78-07304 5C

## METAL PIPES

Piping Materials: Little Furor: Some Change,  
W78-07414 8G

GRP Pipe for Sewage Discharge at Sea,  
W78-07415 8G

Ductile-Iron Pipe Gallery,  
W78-07416 8G

## METALLURGY

Arrestment of Fumes in the Non-Ferrous Metals Industry,  
W78-07596 5G

## METALS

Removal of Chromium Anions from Industrial Effluents--By Contacting with Particles of Insoluble Lead CPD Adsorbed on Particulate Insoluble Carrier,  
W78-07256 5D

A New Dialysis-Ion Exchange Technique for Determining the Forms of Trace Metals in Water,  
W78-07277 5A

Implementing Cost-Effective Pollution Control by Means of Effluent Charges: An Example Applied to Electroplating Discharges,  
W78-07481 5G

Plater Meets 'New Source' Requirements,  
W78-07593 5D

Arrestment of Fumes in the Non-Ferrous Metals Industry,  
W78-07596 5G

Treatment of Some Industrial Effluents in Malaysia,  
W78-07602 5D

METHANE  
Treatment and Use of Sewage Purification Plant Sludges,  
W78-07425 5D

METHOD OF CHARACTERISTICS  
Free Surface Flow Computations by Characteristics,  
W78-07493 2F

# SUBJECT INDEX

## METHOD OF CHARACTERISTICS

### METHODOLOGY

Nonstructural Floodplain Planning, W78-07221 6F

A Study of Different Analytical Extraction Methods for Nondetrimental Heavy Metals in Aquatic Sediments, W78-07278 5A

Determination of Total Organic Carbon in Potable Water, Sewage, Industrial Effluents, and Boiler Feed Water, W78-07404 5A

### METHYLMERCURY

A Comparative Study of the Effects of Mercury Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, *Artemia Salina*, W78-07668 5C

### MEXICO

The 1973 Agreement on Colorado River Salinity Between the United States and Mexico, W78-07643 6E

### MICHIGAN

Planning Guidelines for Residential and Path Development in Michigan's Sand Dunes and Wetlands, W78-07227 4A

Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland, W78-07279 5C

Prediction of Temperature Due to Heated Discharges, W78-07495 5B

### MICROBIOLOGY

Microbiological Aspects of Pollution and Self-Purification of the Water of the River Danube on its Czechoslovak Section (In German), W78-07267 5C

### MICROORGANISMS

Biological Wastewater System, W78-07656 5D

### MILITARY RESERVATIONS

Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico, W78-07352 8B

### MILLS

Suggested Method for Vanadate Removal from Mill Effluents, W78-07332 5D

### MIMBRES VALLEY DECISION (N MEX)

Case Note: Water and Water Courses -- Limiting the Reservation Doctrine. *Mimbres Valley Irrigation Co. v. Salopek*, 564 P.2d 615(N.M.1977), cert.granted, 46U.S.L.W. 3426(No.77-510), W78-07211 6E

### MINERALIZATION

Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C

### MINIMUM FLOW

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Executive Summary), W78-07563 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Executive Summary), W78-07564 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Final Report), W78-07565 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Case Studies), W78-07566 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Final Report), W78-07567 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Rocky Mountain Region Case Studies), W78-07568 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Pacific Northwest Region Case Studies), W78-07569 6G

### MINNESOTA

Water Resources Data for Minnesota, Water Year 1976, W78-07313 7C

### MISSISSIPPI

Some Parasites and Diseases of Estuarine Fishes in Polluted Habitats of Mississippi, W78-07546 5C

### MISSISSIPPI RIVER

Mississippi River Basin Sterol Assay Project Report. Coprostanol, A Positive Molecular Marker of Domestic and Run-Off Sewage, Wastewater Plant Effluent and Surface Waters in the Burlington, Iowa Area on the Mississippi River, W78-07329 5A

### MISSISSIPPI RIVER BASIN

Problem Identification and Ranking, An Assessment of a River Basin Planning Process, W78-07687 6B

### MISSOURI

Relationship Between Groundwater Resources and Energy Production in Southwestern Missouri, W78-07202 2K

### MISSOURI RIVER

Missouri River Basin Sterol Assay Project Report. Coprostanol, A Positive Molecular Marker of Domestic and Run-Off Pollution: Sterol Assay of Wastewater Plant Effluents and Surface Waters of the Lower Main Stem Missouri, W78-07328 5A

### MIXING

Hydraulic Modeling of Mixing in Stratified Lakes, W78-07218 5B

A Simple Model for Cross-Shelf Mixing on the Scotian Shelf, W78-07366 2L

Effluent Mixing Zone in a Shallow River, W78-07483 5B

Circumferential Diffusion in Pipe Mixing, W78-07488 8B

### MODEL STUDIES

Method of Average Birth and Death Rate Evaluation in the Marine-Terrestrial Bacteria Interactions, W78-07263 5C

IBM 1130 Computation Process in the Study of Biophysical Constants Variations of Pathogenous Bacteria by Phytoplankton, W78-07264 5C

COPEPOD4: A Discrete Time-Delay Model of Copepod Population Dynamics, W78-07289 5B

A Generalized Water Quality Model for Eutrophic Lakes and Reservoirs, W78-07290 5C

Urban Runoff Pollution Control--State-of-the-Art, W78-07335 5G

Unsteady-State Water-Quality Model, W78-07348 5B

Preliminary Digital Model of the Arikaree Aquifer in the Sweetwater River Basin, Central Wyoming, W78-07351 2F

The Use of Galerkin Finite-Element Methods to Solve Mass-Transport Equations, W78-07354 5B

Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado, W78-07356 5B

Artificial Ground-Water Recharge with Capillarity, W78-07365 4B

A Simple Model for Cross-Shelf Mixing on the Scotian Shelf, W78-07366 2L

Steady-State Solute Convection in Two Dimensions with Nonuniform Infiltration, W78-07381 2G

Dispersion in Soil Columns: Effect of Boundary Conditions and Irreversible Reactions, W78-07386 2G

Porous Media Tests of Groundwater Mounds, W78-07387 2F

Nonstationarity of the Mean and the Hurst Phenomenon, W78-07388 2E

Some Properties of Variance Reduction Techniques Where Hydrological Extremes Are Estimated by Monte Carlo Simulation, W78-07391 2E

The Dishonest Method in Stream Temperature Modeling, W78-07392 2D

Development of a Two Dimensional Hydrodynamic Numerical Model for Use in a Shallow, Well-Mixed Estuary, W78-07408 2L

Phosphorus Removal by Precipitation with FE (III), W78-07465 5D

# SUBJECT INDEX

## NARRAGANSETT BAY (RI)

- Chlinoptilolite Column Ammonia Removal Model, W78-07466 5D
- Circumferential Diffusion in Pipe Mixing, W78-07488 8B
- Prediction of Temperature Due to Heated Discharges, W78-07495 5B
- Solute Transport Through Soil with Nonuniform Water Content, W78-07496 2G
- Transient-And Steady-Flow Experiments Testing Theory of Water Flow in Saturated Bentonite, W78-07497 2G
- Investigation of Level Fluctuations in Closed Bodies of Water on the Basis of Stochastic Models of the Elements of the Hydrologic Budget, W78-07500 2E
- Computation of the Pattern of Currents in Rivers and Nonstratified Reservoirs, W78-07502 2E
- Boundary Conditions in Modeling Water Flow in Unsaturated Soils, W78-07503 2G
- Calculations of the Thermal Regime of Earthen Dams Considering Their Construction by Layers, W78-07514 8D
- Modeling Salinity of Irrigation Return Flow Where Sources and Sinks are Present, W78-07617 5B
- Practical Applications of Irrigation Return Flow Quality Models to Large Acreages, W78-07629 5G
- Water Distribution Patterns for Sprinkler and Surface Irrigation Systems, W78-07631 3F
- Hydro-Salinity Models: Sensitivity to Input Variables, W78-07632 5B
- Modeling the Irrigation Return Flow System--Current Capabilities and Future Needs, W78-07633 5G
- Economics of Controlling Irrigation Return Flow in the Mesilla Valley, New Mexico, W78-07635 5G
- Modeling Salt Transport in the Irrigated Soils of Grand Valley, W78-07648 5B
- Nearshore Numerical Storm Surge and Tidal Simulation, W78-07679 8B
- An Energy Model of Pennsylvania, W78-07685 6A
- Urban Hydrological Modeling and Catchment Research: International Summary, W78-07689 2A
- Urban Hydrological Modeling and Catchment Research in the Netherlands, W78-07692 2A
- Urban Hydrological Modeling and Catchment Research in Norway, W78-07693 2A
- Urban Hydrological Modeling and Catchment Research in France, W78-07694 2A
- Urban Hydrological Modeling and Catchment Research in Sweden, W78-07695 2A
- Urban Hydrology Studies and Mathematical Modeling in the Federal Republic of Germany, W78-07696 2A
- Urban Hydrological Modeling and Catchment Research in the United Kingdom, W78-07698 2A
- Urban Hydrological Modeling and Catchment Research in Australia, W78-07699 2A
- Urban Hydrological Modeling and Catchment Research in the U.S.A., W78-07700 2A
- MODIFIED PULS METHOD**  
Downstream-Upstream Reservoir Routing, W78-07344 4A
- MOISTURE CONTENT**  
Solute Transport Through Soil with Nonuniform Water Content, W78-07496 2G
- MOISTURE METERS**  
Monitoring in the Zone of Aeration, W78-07470 5A
- MOLLUSKS**  
Viruses in Water: The Increasing Urgency of the Problem and Approaches to its Solution (In Russian), W78-07261 5G
- MONITORING**  
Oil Pollution Monitoring and Monitoring Unit, W78-07234 5A
- Flow Monitoring Apparatus, W78-07236 5D
- Contaminating Spill Detection Arrangement, W78-07241 5A
- Monitoring of Waters for Bdellovibrio Bacteriovorus - A Parasite of Gram Negative Enteric Bacteria Present in Sewage, W78-07323 5A
- Chlorine Detector Saves a Life, W78-07453 5A
- Gas Monitors for Sewage Treatment Works, W78-07454 5A
- Sampling of Water and Wastewater, W78-07517 5A
- Investigation of Remote Water-Quality Monitoring Systems for Use With GOES or ERTS Water Data Transmitter, W78-07678 5A
- MONOSEX FISH**  
Production of Monosex White Amur for Aquatic Plant Control, W78-07326 4A
- MONTANA**  
Water-Level Changes in Wells Along the West Side of the Cedar Creek Anticline, Southeastern Montana, W78-07357 4B
- MONTE CARLO METHOD**  
Some Properties of Variance Reduction Techniques Where Hydrological Extremes Are Estimated by Monte Carlo Simulation, W78-07391 2E
- MONTEREY BAY (CALIF)**  
Patterns of Succession in Benthic Infaunal Communities Following Dredging and Dredged Material Disposal in Monterey Bay, W78-07677 5C
- MORTALITY**  
Evaluation of Water Quality of Puget Sound and Hood Canal in 1976, W78-07544 5C
- Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes Pugio: Importance of Free Cadmium Ion, W78-07662 5C
- MOSCOW (USSR)**  
Transformation of the Hydrologic Budget of the Moscow City Area, W78-07376 4C
- MOUNTAINS**  
Analysis of Intense Precipitation in the Krasnoyarsk Area, W78-07374 2B
- MOVEABLE-BED MODELS**  
Physical Hydraulic Models: Assessment of Predictive Capabilities; Report 2. Moveable-Bed Model of Galveston Harbor Entrance, W78-07672 8B
- MOVEMENT**  
Visual Observations of Floating Ice from Skylab, W78-07346 2C
- Copper Sensitivity of Gonyaulax Tamarensis, W78-07664 5C
- MULTIPLE-PURPOSE RESERVOIRS**  
West Point Lake Postimpoundment Study, W78-07287 5C
- MUNICIPAL WASTES**  
Make Wastewater More Versatile: Reuse it for Recreation Lakes, W78-07217 5D
- MUSSELS**  
A Test of the Effects of Domestic Sewage on the Growth of the Common Blue Mussel, Mytilus Edulis, in an Aquacultural System, W78-07205 5C
- MYRIOPHYLLUM HETEROPHYLLUM MICHX.**  
Distribution, Growth, and Phosphorus Relationships of Myriophyllum Heterophyllum Michx. in Lake Winnepesaukee, New Hampshire, W78-07482 5C
- NARRAGANSETT BAY (RI)**  
Generation of Tidal Current and Height Charts for Narragansett Bay Using a Numerical Model, W78-07555 2I



# SUBJECT INDEX

## NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM

### NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM

How the NPDES Program Will Define Present Water Quality Conditions, W78-07637 5G

The EPA General Permit Program, W78-07651 5G

### NATURAL RESOURCES

The South Dakota Cooperative Land use Effort: A State Level Remote Sensing Demonstration Project, W78-07315 4A

Land Use and Environmental Assessment in the Central Atlantic Region, W78-07317 4A

Energy and Water, W78-07508 6D

### NAVIGATION CHANNELS

Sedimentation of River Navigation Channels, W78-07486 2J

Physical Hydraulic Models: Assessment of Predictive Capabilities; Report 2, Movable-Bed Model of Galveston Harbor Entrance, W78-07672 8B

### NEBRASKA

Nonpoint Nitrate Contamination of Ground Water in Merrick County, Nebraska, W78-07506 5B

### NEUTRALIZATION

Concentration of Acetic Acid in Sulfite Pulp Evaporation Drain by Reverse Osmosis, W78-07598 5D

### NEUTRON ACTIVATION ANALYSIS

Determination of Trace Elements in the English Coulee System: Presence Due to Extended Lignite Burning, W78-07208 5A

### NEW ENGLAND

Plant Species Diversity in a Marine Intertidal Community: Importance of Herbivore Food Preference and Algal Competitive Abilities, W78-07341 2L

### NEW HAMPSHIRE

Distribution, Growth, and Phosphorus Relationships of Myriophyllum Heterophyllum Michx. in Lake Winnepesaukee, New Hampshire, W78-07482 5C

### NEW JERSEY

Macrobenthos of the Tidal Delaware River Between Trenton and Burlington, New Jersey, W78-07300 5C

Nitrification in Four Acidic Streams in Southern New Jersey, W78-07353 5C

Dielectric Constant and Electroconductance of Some Dry Frost-Prone Soils, W78-07369 2C

### NEW MEXICO

Application of Modern Irrigation Technology in the Mesilla Valley, New Mexico, W78-07634 3C

Economics of Controlling Irrigation Return Flow in the Mesilla Valley, New Mexico, W78-07635 5G

### NEW YORK

Inventory of Lake Ontario Inlets and Harbors: Niagara River to Stony Creek, W78-07225 2H

Modernization and Improvement of New York's Riparian Law, W78-07410 6E

Two-Dimensional Plume in Uniform Ground-Water Flow, W78-07490 5B

Suspended-Matter Distribution in the New York Bight Apex Related to Hurricane Belle, W78-07509 2L

### NEW YORK BIGHT

Suspended-Matter Distribution in the New York Bight Apex Related to Hurricane Belle, W78-07509 2L

Marine Waste Disposal in the New York Bight--Public Policy, Environmental Impacts, and Alternative Futures, W78-07529 5E

Circulation. MESA New York Bight Atlas Monograph 3, W78-07541 2L

Water Quality. MESA New York Bight Atlas Monograph 27, W78-07542 5B

Industrial Wastes, MESA New York Bight Atlas Monograph 30, W78-07547 5B

The 1973 Bathymetric Survey in the New York Bight Apex: Maps and Geological Implications, W78-07548 2L

### NEW ZEALAND

Hydrogeology of Metropolitan Christchurch, W78-07368 4B

### NICKEL

Plater Meets 'New Source' Requirements, W78-07593 5D

### NIGHT SOIL TREATMENT

Night Soil Treatment by 'Denipac Process'--Kawamuko Treatment Plant, Matsue City (2), (Denipakku purosuesu ni yoru shinyo shori-matsue shi kawamuko shorijo), W78-07478 5D

### NITRATES

The Relationship of Lake Quality to Specific Urbanization Stresses, W78-07204 5C

Studies on the Toxicity of Ammonia, Nitrate and their Mixtures to Guppy Fry, W78-07214 5C

Nitrogen Transformations in Land Treatment, W78-07216 5B

Operating Activated-Sludge Plants to Effect Nutrient Removal, W78-07441 5D

Nonpoint Nitrate Contamination of Ground Water in Merrick County, Nebraska, W78-07506 5B

Rate of Ammonium Nitrification and Nitrate Leaching in Soil Columns, W78-07520 5B

Nutrient Distributions and Transport in Long Island Sound, W78-07550 5B

Nitrate Movement in Clay Soils and Methods of Pollution Control, W78-07609 5B

Variability of Nitrate Leaching Within Defined Management Units, W78-07612 5B

Soil Nitrate Concentrations in Corn Plots Treated with Isotopically Labeled Nitrogen Fertilizer, W78-07614 5B

Theoretical and Experimental Observations of Water and Nitrate Movement Below a Crop Root Zone, W78-07615 5B

### NITRIFICATION

Nitrification and Nitrogen Removal, W78-07215 5D

Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C

Nitrification in Four Acidic Streams in Southern New Jersey, W78-07353 5C

Operating Activated-Sludge Plants to Effect Nutrient Removal, W78-07441 5D

Nitrification Systems with Integrated Phosphorus Precipitation, W78-07450 5D

pH Averaging, W78-07456 5A

Rate of Ammonium Nitrification and Nitrate Leaching in Soil Columns, W78-07520 5B

Biological Wastewater System, W78-07656 5D

### NITRILOTRIACETIC ACID

Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes pugio: Importance of Free Cadmium Ion, W78-07662 5C

Copper Sensitivity of Gonyaulax Tamarensis, W78-07664 5C

### NITROGEN

Nitrogen Transformations in Land Treatment, W78-07216 5B

Nitrogen Transformation in Lakes, W78-07262 5C

The Impact of Nitrogen and Phosphorus Release from a Siliceous Sediment on the Overlying Water, W78-07302 5C

The Production of Protein from Municipal Sludge, W78-07447 5D

Lawton Advanced Wastewater Treatment Plant, W78-07452 5D

# SUBJECT INDEX

## OHIO

- Long  
SB  
Methods  
Defined  
SB  
Plots  
nitrogen  
SB  
ions of  
a Crop  
SB  
SD  
Accu-  
stances  
SC  
ams in  
SC  
Effect  
SD  
Integrated  
SD  
SA  
Nitrate  
SB  
SD  
toxicity of  
monotes  
on,  
SC  
arensis,  
SC  
Treatment,  
SB  
SC  
phosphorus  
the Over-  
SC  
Municipal  
SD  
Treatment  
SD
- Night Soil Treatment by 'Denipac Process'--  
Kawamuko Treatment Plant, Matsue City (2),  
(Denipakku purosusu ni yoru shinyo shori-mat-  
sue shi kawamulo shorijo),  
W78-07478 5D
- Nitrogen and Water Management to Minimize  
Return-Flow Pollution from Potato Fields of  
the Columbia Basin,  
W78-07611 5G
- NITROGEN COMPOUNDS**  
pH Averaging,  
W78-07456 5A
- NON-STRUCTURAL ALTERNATIVES**  
Effect of the Small Watershed Program on  
Major Uses of Land: Examination of 60 Pro-  
jects in the Southeast, Mississippi Delta, and  
Missouri River Tributaries Regions,  
W78-07330 4D
- Evaluation of the Cost-Effectiveness of Non-  
structural Pollution Controls: A Manual for  
Water Quality Management Planning,  
W78-07336 5G
- NONPENETRATING WELLS**  
Flow to a Nonpenetrating Well in a Leaky Ar-  
tesian Aquifer with Variable Discharge,  
W78-07378 2F
- NONPOINT POLLUTION**  
Detection of Nonpoint Pollution of Small  
Streams in Southwestern Connecticut,  
W78-07334 5A
- NONUNIFORM FLOW**  
Free Surface Flow Computations by Charac-  
teristics,  
W78-07493 2E
- NORTH AMERICA**  
Visual Observations of Floating Ice from  
Skylab,  
W78-07346 2C
- NORTH CAROLINA**  
Summary Report - The Chowan River Project,  
W78-07318 5C
- Alum Treatment of High-Rate Trickling Filter  
Effluent at Chapel Hill, North Carolina,  
W78-07409 5D
- Comparison of Numerical Simulation Flow  
Models for Coastal Inlets,  
W78-07472 2L
- NORTH DAKOTA**  
Wind Powered Artificial Aeration of Northern  
Prairie Lakes,  
W78-07201 8C
- An Analytical Evaluation of the Utilization and  
Management of Water Resources in the Lake  
Metigoshe Watershed, North Dakota,  
W78-07209 5C
- NORTH DAKOTA (GRAND FORKS)**  
Determination of Trace Elements in the English  
Coulee System: Presence Due to Extended Lig-  
nite Burning,  
W78-07208 5A
- NORTH PLATTE RIVER (WYO)**  
Water Quality Model for the Upper North  
Platte River,  
W78-07206 5B
- NORTHERN PIKE**  
Northern Pike Production in Managed  
Spawning and Rearing Marshes,  
W78-07293 5C
- NORTHERN PRAIRIE LAKE (N DAK)**  
Wind Powered Artificial Aeration of Northern  
Prairie Lakes,  
W78-07201 8C
- NORTHUMBERLAND COUNTY (VIRGINIA)**  
Northumberland County Tidal Marsh Invento-  
ry,  
W78-07311 2L
- NORWAY**  
Urban Hydrological Modeling and Catchment  
Research in Norway,  
W78-07693 2A
- NOVA SCOTIA**  
A Simple Model for Cross-Shelf Mixing on the  
Scotian Shelf,  
W78-07366 2L
- NUMERICAL ANALYSIS**  
Artificial Ground-Water Recharge with Capil-  
larity,  
W78-07365 4B
- Theory and Numerical Analysis of Moving  
Boundary Problems in the Hydrodynamics of  
Porous Media,  
W78-07389 2F
- NUTRIENT FLUX**  
The Impact of Nitrogen and Phosphorus  
Release from a Siliceous Sediment on the Over-  
lying Water,  
W78-07302 5C
- NUTRIENT REMOVAL**  
Nitrification and Nitrogen Removal,  
W78-07215 5D
- Restoration of Lower St. Regis Lake (Franklin  
County, New York),  
W78-07291 5G
- New System Cuts Phosphorus for Less Cost,  
W78-07301 5D
- Data Report--Marsh/Pond System,  
W78-07338 5D
- Nitrification Systems with Integrated  
Phosphorus Precipitation,  
W78-07450 5D
- Lawton Advanced Wastewater Treatment  
Plant,  
W78-07452 5D
- Process Design Manual for Phosphorus  
Removal,  
W78-07527 5D
- NUTRIENT REQUIREMENTS**  
The Utilization of Dissolved Organic Com-  
pounds in Aquatic Environments,  
W78-07296 5C
- Operating Activated-Sludge Plants to Effect  
Nutrient Removal,  
W78-07441 5D
- NUTRIENTS**  
Stable Nitrogen-Containing Dissolved Organic  
Substance in Lake Schochsee and in Cultures  
of Algae (In German),  
W78-07260 5B
- Background Ecology and the Effects of  
Nutrient Additions on a Central Michigan Wet-  
land,  
W78-07279 5C
- Physical-Chemical Methods for the Control of  
Algal Species and Composition in Algal Cultur-  
ing Facilities,  
W78-07324 5G
- Nutrient Distributions and Transport in Long  
Island Sound,  
W78-07550 5B
- Nutrient, Bacterial, and Virus Control as Re-  
lated to Ground Water Contamination,  
W78-07571 5B
- Management Guidelines for Controlling Sedi-  
ments, Nutrients, and Adsorbed Biocides in Ir-  
rigation Return Flows,  
W78-07622 5G
- On-Farm Method for Controlling Sediment and  
Nutrient Losses,  
W78-07626 5G
- Economic Analysis of On-Farm Methods for  
Controlling Sediment and Nutrient Losses,  
W78-07627 5G
- Sewage Fungus Growth in Rivers Receiving  
Paper Mill Effluent,  
W78-07655 5C
- OCEAN CURRENTS**  
Circulation. MESA New York Bight Atlas  
Monograph 3,  
W78-07541 2L
- Surface Currents as Determined by Drift Card  
Releases Over the Continental Shelf Off Cen-  
tral and Southern California,  
W78-07556 5B
- OCEAN DUMPING**  
Industrial Wastes, MESA New York Bight  
Atlas Monograph 30,  
W78-07547 5B
- OCEAN TIDES**  
Circulation. MESA New York Bight Atlas  
Monograph 3,  
W78-07541 2L
- OCEANOGRAPHY**  
Linear and Nonlinear Wave Action Estimates,  
W78-07485 2L
- OCEANS**  
Salinity: Its Definition and Calculation,  
W78-07367 2K
- ODOR**  
Ozone in the Treatment of Odors from Sewage  
Works,  
W78-07434 5D
- ODOR CONTROL**  
Odor and Corrosion Control,  
W78-07430 5D
- OGALLALA AQUIFER**  
Western Kansas Faces Declining Water Table,  
W78-07583 4B
- OHIO**  
Dye Infusion Technique Assesses Stream Pol-  
lution in Ohio,  
W78-07373 5B

# SUBJECT INDEX

## OIL POLLUTION

### OIL POLLUTION

Concentrators for Recovering Liquid Pollutant Floating on the Surface of a Sheet of Water, W78-07233 5G

Oil Pollution Monitoring and Monitoring Unit, W78-07234 5A

Oil Salvage Ship with Ocean Going Bow, W78-07239 5G

Contaminating Spill Detection Arrangement, W78-07241 5A

Process for Clarification of Oil-Containing Waste, W78-07248 5D

Device for Collecting Light-Weight Substances Floating on a Liquid Surface, W78-07253 5G

Investigation of Oil Pollution on the Polish Baltic Coast in 1974/1975 (In Polish), W78-07265 5B

An Evaluation of Oil and Grease Contamination Associated with Dredged Material Containment Areas, W78-07681 5G

### OIL SPILLS

Concentrators for Recovering Liquid Pollutant Floating on the Surface of a Sheet of Water, W78-07233 5G

Oil Salvage Ship with Ocean Going Bow, W78-07239 5G

Contaminating Spill Detection Arrangement, W78-07241 5A

Ratting Methods Applied to Gas Chromatographic Data for Oil Identification, W78-07269 5A

Surface Drifter Movements Observed in Outer Strait of Juan de Fuca, July 1977, W78-07545 5B

### OIL WASTES

Measuring Petroleum Hydrocarbons in Digested Sewage Sludges, W78-07462 5A

### OIL-WATER INTERFACES

The Development of a Hydroperm (TM) Microfiltration System for the Treatment of Domestic Wastewater Effluents, W78-07526 5D

### OILY WATER

Method for Clarifying Waste Water Containing Finely Divided Oily Materials, W78-07245 5D

Process for Clarification of Oil-Containing Waste, W78-07248 5D

### OKLAHOMA

Hydraulic Modeling of Mixing in Stratified Lakes, W78-07218 5B

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1977 Water Year, W78-07345 4A

Derivation of Initial Soil Moisture Accounting Parameters from Soil Properties for the National Weather Service River Forecast System, W78-07551 2G

### ON-SITE INVESTIGATIONS

Dallas Urban Runoff, Storm of February 11, 1977, W78-07361 2B

### ON-SITE TESTS

Improved Under-Water Sampler for Limnological Work, W78-07276 7B

### OPEN CHANNEL FLOW

Lined: A One Dimensional Multireach Sediment Transport Model, W78-07363 2J

### OPERATION AND MAINTENANCE

National Needs for Combined Sewer Overflow Control, W78-07422 5D

Ozone in the Treatment of Odors from Sewage Works, W78-07434 5D

### OPTIMIZATION

Nonstructural Floodplain Planning, W78-07221 6F

Problems Encountered in the Up-Grading of Some Small Sewage Works, W78-07427 5D

Capacity Planning for Regional Wastewater Treatment Systems, W78-07521 5D

Combining Agricultural Improvements and Desalting of Return Flows to Optimize Local Salinity Control Policies, W78-07628 5G

### OPTIMUM DEVELOPMENT PLANTS

The Research Works on Sewage Treatment in Poland, W78-07531 5D

### OREGON

An Engineering Report on Selected Reservoir Sites in the Bandon Area, W78-07280 6B

Freshwater Resources of the Oregon Coastal Zones, W78-07281 2L

Irrigation Water Supply Study for Red Prairie Irrigation District, Polk and Yamhill Counties, Oregon, W78-07282 3F

### ORGANIC ACIDS

Concentration of Acetic Acid in Sulfite Pulp Evaporation Drain by Reverse Osmosis, W78-07598 5D

Chrome Dyeing of Wool: Reducing the Amount of Chromium in the Residual Bath, W78-07601 5D

### ORGANIC CARBON

Field Measured Flux of Volatile Denitrification Products as Influenced by Soil Water Content and Organic Carbon Source, W78-07613 5G

### ORGANIC COMPOUNDS

Total Organic Halogen as Water Quality Parameter: Adsorption/Microcoulometric Method, W78-07273 5A

The Utilization of Dissolved Organic Compounds in Aquatic Environments, W78-07296 5C

Measuring Petroleum Hydrocarbons in Digested Sewage Sludges, W78-07462 5A

European Water Treatment Practices and What We Can Learn from Them, W78-07604 5F

### ORGANIC MATTER

Stable Nitrogen-Containing Dissolved Organic Substance in Lake Schochsee and in Cultures of Algae (In German), W78-07260 5B

Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C

### ORGANIC WASTES

The Role of Surface Microlayer of Water in the Distribution and Fate of Trace Organic Contaminants: A Feasibility Study, W78-07319 5B

Adsorption of Textile Dyes by Activated Carbon Produced from Agricultural, Municipal and Industrial Wastes, W78-07599 5D

Mutant Bacteria Solve BOD Problem at Heat Packing Plant, W78-07603 5D

Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent, W78-07655 5C

### ORIFICES

Orifice Effects on Oscillatory Flow, W78-07487 8B

### OSCILLATORY FLOW

Orifice Effects on Oscillatory Flow, W78-07487 8B

### OUTER CONTINENTAL SHELF

Technical and Philosophical Aspects of Ocean Disposal, W78-07540 5E

Circulation, MESA New York Bight Atlas Monograph 3, W78-07541 2L

Water Quality, MESA New York Bight Atlas Monograph 27, W78-07542 5B

Nearshore Fish and Macroinvertebrate Assemblages Along the Strait of Juan de Fuca Including Food Habits of Nearshore Fish, W78-07543 2L

Surface Drifter Movements Observed in Outer Strait of Juan de Fuca, July 1977, W78-07545 5B

The 1973 Bathymetric Survey in the New York Bight Apex: Maps and Geological Implications, W78-07548 2L

Surface Currents as Determined by Drift Card Releases Over the Continental Shelf Off Central and Southern California, W78-07556 5B

Environmental Assessment of the Alaskan Continental Shelf, Annual Reports Summary for the Year Ending March 1977, W78-07557 6G



# SUBJECT INDEX

## PATENTS

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter April - June 1977. W78-07558 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter April - June 1977. W78-07559 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter July - September 1977. W78-07560 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter July - September 1977. W78-07561 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume III. Principal Investigators' Reports for the Quarter July - September 1977. W78-07562 6G

## OUTFALL SEWERS

Wastewater Effluent Line Serves Dual Purpose. W78-07419 5E

## OUTLET WORKS

GRP Pipe for Sewage Discharge at Sea. W78-07415 8G

## OVERFLOW

National Needs for Combined Sewer Overflow Control. W78-07422 5D

Cottage Farm Combined Sewer Detection and Chlorination Station, Cambridge, Massachusetts. W78-07534 5D

## OXIDATION

Method for Purification of Industrial Waste Water. W78-07247 5D

Water Purifying Device Without Movable Mechanical Part in Contact with the Liquid to be Treated. W78-07252 5D

A Pilot Plant Study on Advanced Treatment of Treated Sewage for Re-Use. (In Japanese). W78-07445 5D

Ozonation of Coal Gasification Plant Wastewater. W78-07589 5A

## OXIDATION LAGOONS

Industrial Waste Management in the Dairy Industry in Poland. W78-07590 5D

## OXIDATION PONDS

Hygienic Evaluation of Effectiveness of Urban Sewage Purification in Oxidation Ponds (In Russian). W78-07270 5D

## OXYGEN

Air vs O2: Two Activated Sludge Systems Compared. W78-07451 5D

## OXYGEN DEPLETION

Use of Zooplanktophagic Fishes in Channel Catfish Production Ponds. W78-07292 5C

## OXYGENATION

Unified Presentation of Weir-Aeration Data. W78-07494 2E

Wastewater Treatment System. W78-07580 5D

## OYSTERS

Evaluation of Water Quality of Puget Sound and Hood Canal in 1976. W78-07544 5C

## OZONE

Ozone in the Treatment of Odors from Sewage Works. W78-07434 5D

Recent Advances in Ozone Technology. W78-07444 5D

Photographic Processing Effluent Control. W78-07588 5D

Ozonation of Coal Gasification Plant Wastewater. W78-07589 5A

European Water Treatment Practices and What We Can Learn from Them. W78-07604 5F

## PACIFIC NORTHWEST

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Pacific Northwest Region Case Studies). W78-07569 6G

## PACIFIC NORTHWEST U.S.

Pollution in the Northeast Pacific Ocean. W78-07325 5B

North American Glacial History Extended to 75,000 Years Ago. W78-07372 2C

Instream Flow Decision-Making in the Pacific Northwest. W78-07480 6E

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Executive Summary). W78-07563 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Final Report). W78-07567 6G

## PACIFIC OCEAN

Annual Fluctuations in Biomass of Taxonomic Groups of Zooplankton in the California Current. W78-07275 5C

Pollution in the Northeast Pacific Ocean. W78-07325 5B

## PACKERS

Packers and Seals Serve Many Uses. W78-07585 8C

## PALAEMONETES

Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes Pugio: Importance of Free Cadmium Ion. W78-07662 5C

## PARASITES

Some Parasites and Diseases of Estuarine Fishes in Polluted Habitats of Mississippi. W78-07546 5C

## PATENTS

Removal of Chromium, Chromate, Molybdate and Zinc. W78-07231 5D

Concentrators for Recovering Liquid Pollutant Floating on the Surface of a Sheet of Water. W78-07233 5G

Oil Pollution Monitoring and Monitoring Unit. W78-07234 5A

Irrigation Gravel Guard. W78-07235 3F

Flow Monitoring Apparatus. W78-07236 5D

Aeration Tube. W78-07237 3F

Removal of Color from Paper Mill Waste Waters. W78-07238 5D

Oil Salvage Ship with Ocean Going Bow. W78-07239 5G

Element for Filtering and Separating Fluid Mixtures. W78-07240 5D

Contaminating Spill Detection Arrangement. W78-07241 5A

Moisture Sensing Apparatus and Method. W78-07242 3F

Self Cleaning, Pressure Responsive Emitter Valve for Soil Irrigation. W78-07243 3F

Traveling Sprinkler Guide Wheel Assembly. W78-07244 3F

Method for Clarifying Waste Water Containing Finely Divided Oily Materials. W78-07245 5D

Treatment of Water to Remove Certain Ions Therefrom. W78-07246 5F

Process for Clarification of Oil-Containing Waste. W78-07248 5D

Process for Treating Wool Scouring Wastes. W78-07249 5D

Sewage Purification System. W78-07250 5D

Apparatus for Purifying Water. W78-07251 5F

Water Purifying Device Without Movable Mechanical Part in Contact with the Liquid to be Treated. W78-07252 5D

Device for Collecting Light-Weight Substances Floating on a Liquid Surface. W78-07253 5G

## PATENTS

Pretreatment Filter Press Dewatering System,  
W78-07254 5D

Biologically Purifying Waste Water in Air  
Tank--Using Extract of Excess Active Slime as  
Biosimulator.  
W78-07255 5D

Benthic Semi-Barrier to Control the Growth of  
Weeds in Aquatic Environments,  
W78-07257 5G

## PATH OF POLLUTANTS

Role of Plankton in the Behavior of TC99 and  
MN54 in Seawater,  
W78-07286 5C

The Role of Surface Microlayer of Water in the  
Distribution and Fate of Trace Organic Con-  
taminants; A Feasibility Study,  
W78-07319 5B

Radionuclide Concentrations in the Arkansas  
River Upstream and Downstream from the  
Nuclear I Power Generating Facility,  
W78-07320 5B

Uranium-Isotope Variations in Groundwaters  
of the Floridan Aquifer and Boulder Zone of  
South Florida,  
W78-07343 5B

The Use of Galerkin Finite-Element Methods  
to Solve Mass-Transport Equations,  
W78-07354 5B

Dye Infusion Technique Assesses Stream Pol-  
lution in Ohio,  
W78-07373 5B

Nutrient Distributions and Transport in Long  
Island Sound,  
W78-07550 5B

Nitrate Movement in Clay Soils and Methods  
of Pollution Control,  
W78-07609 5B

Effect of Three Irrigation Systems on Distribu-  
tion of Fertilizer Nitrate Nitrogen in Soil,  
W78-07610 5B

Modeling Salinity of Irrigation Return Flow  
Where Sources and Sinks are Present,  
W78-07617 5B

## PATHOGENIC BACTERIA

Method of Average Birth and Death Rate  
Evaluation in the Marine-Terrestrial Bacteria  
Interactions,  
W78-07263 5C

IBM 1130 Computation Process in the Study of  
Biophysical Constants Variations of  
Pathogenous Bacteria by Phytoplankton,  
W78-07264 5C

Monitoring of Waters for *Bdellovibrio* Bac-  
teriovorus - A Parasite of Gram Negative En-  
teric Bacteria Present in Sewage,  
W78-07323 5A

The Dangers of Inadequate Chlorination of Pol-  
luted Waters,  
W78-07435 5D

## PEAK LOADS

Problems Encountered in the Up-Grading of  
Some Small Sewage Works,  
W78-07427 5D

## SUBJECT INDEX

## PENETRATION

Flow to a Nonpenetrating Well in a Leaky Ar-  
tesian Aquifer with Variable Discharge,  
W78-07378 2F

## PENNSYLVANIA

Formulating State Groundwater Policy in  
Pennsylvania,  
W78-07576 5G

An Energy Model of Pennsylvania,  
W78-07685 6A

## PERCH LAKE (ONTARIO)

Hydrological Studies on a Small Basin on the  
Canadian Shield.  
W78-07406 2H

## PERCHES

A Five-Year Monitoring Study of the  
Chlorinated Hydrocarbons in the Fish of a Fin-  
nish Lake Ecosystem,  
W78-07667 5A

## PERCOLATION

Steady-State Solute Convection in Two Dimen-  
sions with Nonuniform Infiltration,  
W78-07381 2G

## PERFORMANCE

Performance of a Trickling Filter, Solids  
Removal, and Anaerobic Digestion System for  
Recycled Poultry Manure Wastewater,  
W78-07207 5D

Problems Encountered in the Up-Grading of  
Some Small Sewage Works,  
W78-07427 5D

Developments in Performance Relationships  
for Sewage,  
W78-07467 5D

## PERMAFROST

Dam of the Kolyma Hydroelectric Power Plant,  
W78-07511 8D

Temperature Regime of Low-Head Earth Dams  
in Central Yakutia,  
W78-07512 8D

## PERMITS

Administrative Practice and Procedure Under  
Permit Systems,  
W78-07411 6E

## PESTICIDE RESIDUES

Analysis of Various Iowa Waters for Selected  
Pesticides: Atrazine, DDE, and Dieldrin--1974,  
W78-07331 5A

Efficacy and Residues of Diquat Applied for  
Control of Egeria and Hydrilla,  
W78-07430 5G

Aquatic Weed Control in Small Reservoirs with  
Diquat,  
W78-07402 5G

Chlorinated Hydrocarbons in Macroinver-  
tebrates and Fish from the Lower Medway  
Estuary, Kent,  
W78-07661 5C

A Five-Year Monitoring Study of the  
Chlorinated Hydrocarbons in the Fish of a Fin-  
nish Lake Ecosystem,  
W78-07667 5A

## PESTICIDES

Microbial Interactions with Pesticides in  
Estuarine Surface Slicks,  
W78-07605 5C

## PHAEODACTYLUM TRICORNUTUM

Photorespiration in Marine Phytoplankton,  
W78-07309 5C

## PHENOLS

Steric Hindrance on Competitive Interaction  
in Activated Carbon Adsorption from BI-Solute  
Solution of Phenol and Organics in Biological  
Treated Sewage, (In Japanese),  
W78-07455 5D

Preservation of Phenolic Compounds in Waste-  
waters,  
W78-07586 5D

Ozonation of Coal Gasification Plant Waste-  
water,  
W78-07589 5A

Microbial Interactions with Pesticides in  
Estuarine Surface Slicks,  
W78-07605 5C

## PHOSPHATES

Distribution, Growth, and Phosphorus Rela-  
tionships of Myriophyllum Heterophyllum  
Michx. in Lake Winnepesaukee, New  
Hampshire,  
W78-07482 5C

## PHOSPHORUS

New System Cuts Phosphorus for Less Cost,  
W78-07301 5D

The Impact of Nitrogen and Phosphorus  
Release from a Siliceous Sediment on the Over-  
lying Water,  
W78-07302 5C

Operating Activated-Sludge Plants to Effect  
Nutrient Removal,  
W78-07441 5D

Maximizing Phosphorus Removal in Activated  
Sludge,  
W78-07446 5D

Nitrification Systems with Integrated  
Phosphorus Precipitation,  
W78-07450 5D

Lawton Advanced Wastewater Treatment  
Plant,  
W78-07452 5D

Phosphorus Removal by Precipitation with FE  
(III),  
W78-07465 5D

Night Soil Treatment by 'Denipac Process'-  
Kawamuko Treatment Plant, Matsue City (2),  
(Denipakku purosusu ni yoru shinyo shori-mat-  
sue shi kawamuko shorijo),  
W78-07478 5D

Distribution, Growth, and Phosphorus Rela-  
tionships of Myriophyllum Heterophyllum  
Michx. in Lake Winnepesaukee, New  
Hampshire,  
W78-07482 5C

Process Design Manual for Phosphorus  
Removal,  
W78-07527 5D

## PHOSPHORUS COMPOUNDS

Preservation of Phenolic Compounds in Waste-  
waters,  
W78-07586 5D

## PHOSTRIP PROCESS

New System Cuts Phosphorus for Less Cost,  
W78-07301 5D

# SUBJECT INDEX

## POLLUTANT IDENTIFICATION

### PHOTOINHIBITION

- Anaerobic ATP Levels in the Blue-Green Alga  
Anabaena: Dark-Light Transients and Effects  
of Light Intensity, W78-07303 5C

### PHOTOPHOSPHORYLATION

- Anaerobic ATP Levels in the Blue-Green Alga  
Anabaena: Dark-Light Transients and Effects  
of Light Intensity, W78-07303 5C

### PHOTORESPIRATION

- Photorespiration in Larger Littoral Algae,  
W78-07274 5C

- Photorespiration in Marine Phytoplankton,  
W78-07309 5C

### PHOTOSYNTHESIS

- The Effect of the Ionic Composition of the En-  
vironment on Oxygen Exchange in the Alga  
Acetabularia (In Russian), W78-07213 5C

- Photorespiration in Larger Littoral Algae,  
W78-07274 5C

- Photorespiration in Marine Phytoplankton,  
W78-07309 5C

- Copper Sensitivity of Gonyaulax Tamarensis,  
W78-07664 5C

### PHYTOPLANKTON

- IBM 1130 Computation Process in the Study of  
Biophysical Constants Variations of  
Pathogenic Bacteria by Phytoplankton,  
W78-07264 5C

- Evolutionary Studies on the Shape of the Cell  
and of the Chloroplast in Desmids,  
W78-07283 2I

- Morphological Investigations of Asymmetry in  
Desmids, W78-07284 2I

- Eulimnion, an Original Place of New Forms,  
W78-07285 5C

- Role of Plankton in the Behavior of TC99 and  
MN54 in Seawater, W78-07286 5C

- The Utilization of Dissolved Organic Com-  
pounds in Aquatic Environments, W78-07296 5C

- The Impact of Nitrogen and Phosphorus  
Release from a Siliceous Sediment on the Over-  
lying Water, W78-07302 5C

- The Relation Between Adenosine Triphosphate  
and Microbial Biomass in Diverse Aquatic  
Ecosystems, W78-07306 5C

- Photorespiration in Marine Phytoplankton,  
W78-07309 5C

- Trace Metal-Chelator Interactions and  
Phytoplankton Growth in Seawater Media:  
Theoretical Analysis and Comparison with Re-  
ported Observations, W78-07663 5C

### PIKES

- A Five-Year Monitoring Study of the  
Chlorinated Hydrocarbons in the Fish of a Fin-  
nish Lake Ecosystem, W78-07667 5A

### PILOT PLANTS

- A Pilot Plant Study on Advanced Treatment of  
Treated Sewage for Re-Use. (In Japanese),  
W78-07445 5D

- Nitrification Systems with Integrated  
Phosphorus Precipitation, W78-07450 5D

- Independent Physical-Chemical Treatment of  
Raw Sewage, W78-07516 5D

- Dye Waste Treatment and Reuse,  
W78-07600 5D

### PIPE FLOW

- Circumferential Diffusion in Pipe Mixing,  
W78-07488 8B

### PIPELINES

- Irrigation Water Supply Study for Red Prairie  
Irrigation District, Polk and Yamhill Counties,  
Oregon, W78-07282 3F

- Wastewater Effluent Line Serves Dual Pur-  
pose, W78-07419 5E

- Los Angeles Faces Several Sludge Manage-  
ment Problems, W78-07448 5D

### PIPES

- GRP Pipe for Sewage Discharge at Sea,  
W78-07415 8G

- Sewage System Rejuvenation, W78-07535 8G

### PLANNING

- Innovative Management Concept for 208  
Planning, W78-07222 5G

- Effect of the Small Watershed Program on  
Major Uses of Land: Examination of 60 Pro-  
jects in the Southeast, Mississippi Delta, and  
Missouri River Tributaries Regions, W78-07330 4D

- Evaluation of the Cost-Effectiveness of Non-  
structural Pollution Controls: A Manual for  
Water Quality Management Planning, W78-07336 5G

- Problem Identification and Ranking, An As-  
sessment of a River Basin Planning Process,  
W78-07687 6B

### PLANT GROWTH

- Greenhouse Studies of the Growth and  
Reproduction of Egeria Densa, W78-07401 4A

### PLANT MORPHOLOGY

- Morphological Investigations of Asymmetry in  
Desmids, W78-07284 2I

### PLANTING MANAGEMENT

- Shoreline Plant Establishment and Use of a  
Wave-Stilling Device, W78-07230 2L

### PLASTIC PIPES

- Piping Materials: Little Furor; Some Change.  
W78-07414 8G

- GRP Pipe for Sewage Discharge at Sea,  
W78-07415 8G

- PVC Pipe Passes Performance and Cost Tests,  
W78-07479 8G

### PLASTICS

- Pollution Control in the Synthetic Resins Indus-  
try, W78-07587 5D

- Sewage Treatment Rotary Distributor Range  
Extended, W78-07658 5D

### PLAYAS

- Flood-Hazard Study--100-Year Flood Stage for  
Lucerne Lake, San Bernardino County,  
California, W78-07359 4A

### POLAND

- Investigation of Oil Pollution on the Polish Bal-  
tic Coast in 1974/1975 (In Polish),  
W78-07265 5B

- Polish/U.S. Symposium on Wastewater Treat-  
ment and Sludge Disposal: Volume II,  
W78-07530 5D

- The Research Works on Sewage Treatment in  
Poland, W78-07531 5D

- Industrial Waste Management in the Dairy In-  
dustry in Poland, W78-07590 5D

- Urban Runoff Research in Poland,  
W78-07691 2A

### POLLUTANT IDENTIFICATION

- Determination of Trace Elements in the English  
Coulee System: Presence Due to Extended Lig-  
nite Burning, W78-07208 5A

- Contaminating Spill Detection Arrangement,  
W78-07241 5A

- Ratioing Methods Applied to Gas Chromato-  
graphic Data for Oil Identification,  
W78-07269 5A

- A New Dialysis-Ion Exchange Technique for  
Determining the Forms of Trace Metals in  
Water, W78-07277 5A

- A Study of Different Analytical Extraction  
Methods for Nondetrimental Heavy Metals in  
Aquatic Sediments, W78-07278 5A

- The Role of Surface Microlayer of Water in the  
Distribution and Fate of Trace Organic Con-  
taminants; A Feasibility Study, W78-07319 5B

- Monitoring of Waters for Bdelovibrio Bac-  
teriovorus - A Parasite of Gram Negative En-  
teric Bacteria Present in Sewage, W78-07323 5A

- Chlorine Detector Saves a Life,  
W78-07453 5A

- Gas Monitors for Sewage Treatment Works,  
W78-07454 5A

- The Background to, and the Application of,  
Laboratory Instrumentation to Water Analysis,  
W78-07458 5A

- Monitoring in the Zone of Aeration,  
W78-07470 5A



# POLLUTANT IDENTIFICATION

Sampling of Water and Wastewater,  
W78-07517 5A

Ozonation of Coal Gasification Plant Waste-  
water,  
W78-07589 5A

A Test and a Technique for Predicting BOD5  
Values of Kraft Mill Waste,  
W78-07597 5A

Chlorinated Hydrocarbons in Macroinver-  
tebrates and Fish from the Lower Medway  
Estuary, Kent,  
W78-07661 5C

A Preliminary Study of the Use of Benthic  
Algae as Biological Indicators of Heavy Metal  
Pollution in Solfjorden, Norway,  
W78-07665 5A

Investigation of Remote Water-Quality Moni-  
toring Systems for Use With GOES or ERTS  
Water Data Transmitter,  
W78-07678 5A

**POLLUTANTS**  
Pollution in the Northeast Pacific Ocean,  
W78-07325 5B

**POLLUTION IDENTIFICATION**  
Determination of Total Organic Carbon in Pot-  
able Water, Sewage, Industrial Effluents, and  
Boiler Feed Water,  
W78-07404 5A

**POLLUTION INDEXES**  
Use of Benthic Sediments as Indicators of  
Marina Flushing,  
W78-07553 5A

**POLLUTION TAXES (CHARGES)**  
Implementing Cost-Effective Pollution Control  
by Means of Effluent Charges: An Example  
Applied to Electroplating Discharges,  
W78-07481 5G

**POLYCHLORINATED BIPHENYLS**  
Microbial Interactions with Pesticides in  
Estuarine Surface Slicks,  
W78-07605 5C

Chlorinated Hydrocarbons in Macroinver-  
tebrates and Fish from the Lower Medway  
Estuary, Kent,  
W78-07661 5C

A Five-Year Monitoring Study of the  
Chlorinated Hydrocarbons in the Fish of a Fin-  
nish Lake Ecosystem,  
W78-07667 5A

**POLYCYCLIC AROMATIC HYDROCARBONS**  
Sedimentary Record of Heavy Metals and  
Polycyclic Aromatic Hydrocarbons in Lake  
Constance (In German),  
W78-07307 5B

**POLYELECTROLYTES**  
Recycling of Water for Irrigation: Persistence  
of Enteroviruses in Sewage Effluent and Natu-  
ral Waters Receiving the Effluent,  
W78-07471 5B

**POLYMER COAGULANT**  
Particle Disruption in Flocculating Systems,  
W78-07321 5F

**POLYMERS**  
Recycling of Water for Irrigation: Persistence  
of Enteroviruses in Sewage Effluent and Natu-  
ral Waters Receiving the Effluent,  
W78-07471 5B

Independent Physical-Chemical Treatment of  
Raw Sewage,  
W78-07516 5D

**PONDS**  
Natural Sewage Recycling Systems  
W78-07515 5D

**PORES**  
The Development of a Hydropem (TM)  
Microfiltration System for the Treatment of  
Domestic Wastewater Effluents,  
W78-07526 5D

**POROLITHON ONKODES**  
Ecological Components Structuring the  
Seaward Edges of Tropical Pacific Reefs: The  
Distribution, Communities and Productivity of  
Porolithon,  
W78-07327 2L

**POROUS MEDIA**  
Porous Media Tests of Groundwater Mounds,  
W78-07387 2F

Theory and Numerical Analysis of Moving  
Boundary Problems in the Hydrodynamics of  
Porous Media,  
W78-07389 2F

The Development of a Hydropem (TM)  
Microfiltration System for the Treatment of  
Domestic Wastewater Effluents,  
W78-07526 5D

**POST-AUDIT STUDIES**  
Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Pacific Northwest Region Case Studies),  
W78-07569 6G

**POTABLE WATER**  
Stability in Drinking and Surface Water of Nine  
Virus Species from Different Genera (In Ger-  
man),  
W78-07272 5C

Total Organic Halogen as Water Quality  
Parameter: Adsorption/Microcoulometric  
Method,  
W78-07273 5A

Concentration of Enteroviruses from Large  
Volumes of Tap Water, Treated Sewage, and  
Seawater,  
W78-07463 5F

European Water Treatment Practices and What  
We Can Learn from Them,  
W78-07604 5F

**POTATOES**  
Starch-Laden Effluent Treatment-A Case His-  
tory,  
W78-07591 5D

The Recovery of Protein From Potato Juice  
Waste Water by Foam Separation,  
W78-07592 5D

Nitrogen and Water Management to Minimize  
Return-Flow Pollution from Potato Fields of  
the Columbia Basin,  
W78-07611 5G

**POTHOLES**  
Productivity of Red-Winged Blackbirds in  
Prairie Pothole Habitat,  
W78-07339 2I

**POULTRY MANURE WASTEWATER**  
Performance of a Trickling Filter, Solids  
Removal, and Anaerobic Digestion System for  
Recycled Poultry Manure Wastewater,  
W78-07207 5D

**POWERPLANTS**  
Impact of a Power Plant on the Ground-Water  
System of a Wetland,  
W78-07377 6G

**PREDATION**  
Plant Species Diversity in a Marine Intertidal  
Community: Importance of Herbivore Food  
Preference and Algal Competitive Abilities,  
W78-07341 2L

**PRESSURE**  
A Multi-Stage Filter Belt Press.  
W78-07666 5E

Solids Dewatering.  
W78-07675 5E

**PRIOR APPROPRIATION**  
General Adjudication Proceedings,  
W78-07412 6E

**PRIORITIES**  
Administrative Practice and Procedure Under  
Permit Systems,  
W78-07411 6E

Practical Aspects of Water Litigation,  
W78-07413 6E

**PROCEDURAL REQUIREMENTS**  
Administrative Practice and Procedure Under  
Permit Systems,  
W78-07411 6E

**PRODUCTIVITY**  
Productivity of Red-Winged Blackbirds in  
Prairie Pothole Habitat,  
W78-07339 2I

**PROJECT PLANNING**  
The Research Works on Sewage Treatment in  
Poland,  
W78-07531 5D

How to Meet Well Project Goals: Part I,  
W78-07581 4B

**PROJECTIONS**  
Analysis of Waste-Load Assimilative Capacity  
of the Yampa River, Steamboat Springs to  
Hayden, Routt County, Colorado,  
W78-07356 5B

**PROTEINS**  
The Production of Protein from Municipal  
Sludge,  
W78-07447 5D

The Recovery of Protein From Potato Juice  
Waste Water by Foam Separation,  
W78-07592 5D

**PUGET SOUND**  
Evaluation of Water Quality of Puget Sound  
and Hood Canal in 1976,  
W78-07544 5C

**PULP AND PAPER INDUSTRY**  
A Test and a Technique for Predicting BOD5  
Values of Kraft Mill Waste,  
W78-07597 5A

Concentration of Acetic Acid in Sulfite Pulp  
Evaporation Drain by Reverse Osmosis,  
W78-07598 5D

**PULP WASTE**  
Biologically  
Tank-Using  
Biostimulat  
W78-07255

A Test and  
Values of K  
W78-07599

Sewage Fu  
Paper Mill  
W78-07655

**PUMP TURB**  
History of  
W78-07417

**PUMPED STO**  
Forced Plur  
W78-07489

**PUMPING**  
Flow to a N  
tesian Aqu  
W78-07378

History of  
W78-07417

**PUMPING PL**  
History of  
W78-07417

**PUMPS**  
Heat Trea  
Sludge,  
W78-07437

Sewage Slu  
Feeding,  
W78-07438

**QUATAL CR**  
Scour and  
Streams,  
W78-07379

**RADIOACTIV**  
North Am  
75,000 Year  
W78-07372

**RADIOACTIV**  
The Relatio  
and Micro  
Ecosystem  
W78-07306

**RADIOACTIV**  
Medically  
Sludge,  
W78-07460

Sub-Seabed  
Prevention  
W78-07536

**RADIOISOTO**  
Role of Pla  
MN54 in So  
W78-07286

Radionuclei  
River Upst  
Nuclear I P  
W78-07320

Medically  
Sludge,  
W78-07460

# SUBJECT INDEX

## RESERVATION DOCTRINE

- PULP WASTES**  
Biologically Purifying Waste Water in Air Tank--Using Extract of Excess Active Slime as Biostimulator. W78-07255 5D
- A Test and a Technique for Predicting BOD5 Values of Kraft Mill Waste. W78-07597 5A
- Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent. W78-07655 5C
- PUMP TURBINES**  
History of Sewage Pumping in Britain. W78-07417 8C
- PUMPED STORAGE**  
Forced Plumes in a Stratified Reservoir. W78-07489 8B
- PUMPING**  
Flow to a Nonpenetrating Well in a Leaky Artesian Aquifer with Variable Discharge. W78-07378 2F
- History of Sewage Pumping in Britain. W78-07417 8C
- PUMPING PLANTS**  
History of Sewage Pumping in Britain. W78-07417 8C
- PUMPS**  
Heat Treatment and Pressing of Digested Sludge. W78-07437 5D
- Sewage Sludge Lime Dosing and Filter Press Feeding. W78-07438 5D
- QUATAT CREEK (CALIF)**  
Scour and Fill in Steep, Sand-Bed Ephemeral Streams. W78-07379 2J
- RADIOACTIVE DATING**  
North American Glacial History Extended to 75,000 Years Ago. W78-07372 2C
- RADIOACTIVE INDICATORS**  
The Relation Between Adenosine Triphosphate and Microbial Biomass in Diverse Aquatic Ecosystems. W78-07306 5C
- RADIOACTIVE WASTE DISPOSAL**  
Medically Used Radionuclides in Sewage Sludge. W78-07460 5A
- Sub-Seabed Disposal of Radioactive Waste: Prevention or Management. W78-07536 5E
- RADIOISOTOPES**  
Role of Plankton in the Behavior of TC99 and MN54 in Seawater. W78-07286 5C
- Radionuclide Concentrations in the Arkansas River Upstream and Downstream from the Nuclear 1 Power Generating Facility. W78-07320 5B
- Medically Used Radionuclides in Sewage Sludge. W78-07460 5A
- RAINFALL**  
Analysis of Intense Precipitation in the Krasnoyarsk Area. W78-07374 2B
- Water Resources and Climatic Change. W78-07380 2A
- RAINFALL-RUNOFF RELATIONSHIPS**  
Rainfall and Runoff Data from Small Basins in Wyoming. W78-07349 7C
- RANNEY WELLS**  
How to Meet Well Project Goals: Part I. W78-07581 4B
- REASONABLE USE**  
Groundwater Law: The Riparian Problem. W78-07578 6E
- RECLAIMED WATER**  
Future Treatment Plant Requirements. W78-07474 5D
- RECREATION DEMAND**  
An Attempt to Quantify the Esthetics of Wild and Scenic Rivers in Idaho. W78-07220 6B
- RECYCLING**  
Performance of a Trickling Filter, Solids Removal, and Anaerobic Digestion System for Recycled Poultry Manure Wastewater. W78-07207 5D
- An Economic Analysis of Irrigation Return Flow Recycle Systems in the Central Valley of California. W78-07625 5G
- RED PRAIRIE (OR)**  
Irrigation Water Supply Study for Red Prairie Irrigation District, Polk and Yamhill Counties, Oregon. W78-07282 3F
- RED TIDE**  
Marine Pollution Hazards. W78-07297 5C
- RED-WINGED BLACKBIRDS**  
Productivity of Red-Winged Blackbirds in Prairie Pothole Habitat. W78-07339 2I
- REEFS**  
Ecological Components Structuring the Seaward Edges of Tropical Pacific Reefs: The Distribution, Communities and Productivity of Porolithon. W78-07327 2L
- REGIONAL ANALYSIS**  
Innovative Management Concept for 208 Planning. W78-07222 5G
- REGIONAL DEVELOPMENT**  
Los Angeles Faces Several Sludge Management Problems. W78-07448 5D
- The Design and Construction of the Martholme Regional Sewage-Treatment Works. W78-07477 5D
- REGRESSION ANALYSIS**  
Technique for Estimating Magnitude and Frequency of Floods in Illinois. W78-07350 4A
- Frequency Analysis of Illinois Floods Using Observed and Synthetic Streamflow Records. W78-07355 4A
- Generation of Ungaged Streamflow Data. W78-07384 2A
- REHABILITATION**  
Restoration of Lower St. Regis Lake (Franklin County, New York). W78-07291 5G
- REMOTE SENSING**  
Contaminating Spill Detection Arrangement. W78-07241 5A
- Land Use and Pollution Patterns on the Great Lakes. W78-07288 5B
- The South Dakota Cooperative Land use Effort: A State Level Remote Sensing Demonstration Project. W78-07315 4A
- The National Land Use Data Program of the U.S. Geological Survey. W78-07316 4A
- Land Use and Environmental Assessment in the Central Atlantic Region. W78-07317 4A
- Visual Observations of Floating Ice from Skylab. W78-07346 2C
- Gas Monitors for Sewage Treatment Works. W78-07454 5A
- Investigation of Remote Water-Quality Monitoring Systems for Use With GOES or ERTS Water Data Transmitter. W78-07678 5A
- REPRODUCTION**  
A Comparative Study of the Effects of Mercuric Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, *Artemia Salina*. W78-07668 5C
- RESEARCH AND DEVELOPMENT**  
The Research Works on Sewage Treatment in Poland. W78-07531 5D
- Urban Hydrological Modeling and Catchment Research: International Summary. W78-07689 2A
- Urban Runoff Research in Poland. W78-07691 2A
- RESEARCH EQUIPMENT**  
Improved Under-Water Sampler for Limnological Work. W78-07276 7B
- RESEARCH PRIORITIES**  
The Research Works on Sewage Treatment in Poland. W78-07531 5D
- RESERVATION DOCTRINE**  
Case Note: Water and Water Courses -- Limiting the Reservation Doctrine. Mimbres Valley Irrigation Co. v. Salopek. 564 P.2d 615(N.M.1977),cert.granted,46U.S.L.W. 3426(No.77-510), W78-07211 6E

# SUBJECT INDEX

## RESERVOIR CONSTRUCTION

### RESERVOIR CONSTRUCTION

- Boring Machines Pick Up Speed on Deep Chicago Sewer Tunnels.  
W78-07423 8C

### RESERVOIRS

- An Engineering Report on Selected Reservoir Sites in the Bandon Area,  
W78-07280 6B
- Irrigation Water Supply Study for Red Prairie Irrigation District, Polk and Yamhill Counties, Oregon.  
W78-07282 3F
- A Generalized Water Quality Model for Eutrophic Lakes and Reservoirs,  
W78-07290 5C
- Downstream-Upstream Reservoir Routing,  
W78-07344 4A
- Aquatic Weed Control in Small Reservoirs with Diquat,  
W78-07402 5G
- Forced Plumes in a Stratified Reservoir,  
W78-07489 8B
- Computation of the Pattern of Currents in Rivers and Nonstratified Reservoirs,  
W78-07502 2E

### RESINS

- Pollution Control in the Synthetic Resins Industry,  
W78-07587 5D

### RESOURCES DEVELOPMENT

- Physical, Chemical, and Biological Characteristics of Nearshore Zone of Sand Key, Florida, Prior to Beach Restoration. Vol. 1,  
W78-07407 2J
- Energy and Water,  
W78-07508 6D
- Environmental Assessment of the Alaskan Continental Shelf. Annual Reports Summary for the Year Ending March 1977.  
W78-07557 6G

### RESPIRATION

- Photorespiration in Marine Phytoplankton,  
W78-07309 5C

### RETURN FLOW

- Nitrogen Transformations in Land Treatment,  
W78-07216 5B
- Wastewater Effluent Line Serves Dual Purpose,  
W78-07419 5E
- Wastewater System Provides New Water Source for St. Petersburg.  
W78-07432 5D
- Proceedings of National Conference: Irrigation Return Flow Quality Management.  
W78-07606 5G
- Nitrogen and Water Management to Minimize Return-Flow Pollution from Potato Fields of the Columbia Basin,  
W78-07611 5G
- Field Measured Flux of Volatile Denitrification Products as Influenced by Soil Water Content and Organic Carbon Source,  
W78-07613 5G

- Minimizing Salt in Return Flow by Improving Irrigation Efficiency.  
W78-07616 5G

- Modeling Salinity of Irrigation Return Flow Where Sources and Sinks are Present.  
W78-07617 5B

- Field Evaluation of Sprinkler Irrigation for Management of Irrigation Return Flow,  
W78-07618 5G

- Effects of Irrigation Management on Soil Salinity and Return Flow Quality,  
W78-07619 5G

- Effect of Irrigation Systems on Water Use Efficiency and Soil Water Solute Concentrations,  
W78-07620 5G

- Scientific Irrigation Scheduling for Salinity Control of Irrigation Return Flow,  
W78-07621 5G

- Management Guidelines for Controlling Sediments, Nutrients, and Adsorbed Biocides in Irrigation Return Flows,  
W78-07622 5G

- Quality of Irrigation Return Flow from Flooded Rice Paddies,  
W78-07623 5B

- Evaluation of Surface Irrigation Return Flows in the Central Valley of California,  
W78-07624 5B

- An Economic Analysis of Irrigation Return Flow Recycle Systems in the Central Valley of California,  
W78-07625 5G

- Combining Agricultural Improvements and Desalting of Return Flows to Optimize Local Salinity Control Policies,  
W78-07628 5G

- Practical Applications of Irrigation Return Flow Quality Models to Large Acreages,  
W78-07629 5G

- Hydro-Salinity Models: Sensitivity to Input Variables,  
W78-07632 5B

- Modeling the Irrigation Return Flow System--Current Capabilities and Future Needs,  
W78-07633 5G

- Application of Modern Irrigation Technology in the Mesilla Valley, New Mexico,  
W78-07634 3C

- Economics of Controlling Irrigation Return Flow in the Mesilla Valley, New Mexico,  
W78-07635 5G

- How the NPDES Program Will Define Present Water Quality Conditions,  
W78-07637 5G

- Local Solutions to Drainage Problems,  
W78-07638 4A

- A Valleywide Solution--The Interagency Drainage Program,  
W78-07639 4A

- Irrigation Return Flow Problems in Yakima Valley,  
W78-07640 5G

- The Sulphur Creek Pilot Project: A Practical Approach to Control of Pollutants Leaving Irrigated Farmlands,  
W78-07641 5G

- An Assessment of Irrigation Efficiencies and Drainage Return Flows from the Wellton-Mohawk Division of the Gila Project,  
W78-07644 3C

- Wellton-Mohawk On-Farm Systems Improvement Program,  
W78-07645 3C

- The Hydro-Salinity System in the Grand Valley,  
W78-07647 5G

- Modeling Salt Transport in the Irrigated Soils of Grand Valley,  
W78-07648 5B

- An Influent Control Approach to Irrigation Return Flow Quality Management,  
W78-07653 5G

- A Process for Identifying, Evaluating and Implementing Solutions for Irrigation Return Flow Problems,  
W78-07654 5G

### REVERSE OSMOSIS

- Concentration of Acetic Acid in Sulfite Pulp Evaporation Drain by Reverse Osmosis,  
W78-07598 5D

### REVIEWS

- Nitrification and Nitrogen Removal,  
W78-07215 5D

- History of Sewage Pumping in Britain,  
W78-07417 8C

- Urban Hydrological Modeling and Catchment Research: International Summary,  
W78-07689 2A

- Urban Hydrological Modeling and Catchment Research in the Netherlands,  
W78-07692 2A

- Urban Hydrological Modeling and Catchment Research in Norway,  
W78-07693 2A

- Urban Hydrological Modeling and Catchment Research in France,  
W78-07694 2A

- Urban Hydrology Studies and Mathematical Modeling in the Federal Republic of Germany,  
W78-07696 2A

- Urban Hydrological Modeling and Catchment Research in the United Kingdom,  
W78-07698 2A

- Urban Hydrological Modeling and Catchment Research in Australia,  
W78-07699 2A

- Urban Hydrological Modeling and Catchment Research in the U.S.A.,  
W78-07700 2A

### RHODE ISLAND

- Generation of Tidal Current and Height Charts for Narragansett Bay Using a Numerical Model,  
W78-07555 2L



# SUBJECT INDEX

## SALMONID PRODUCTION

- RICE**  
Quality of Irrigation Return Flow from Flooded Rice Paddies, W78-07623 5B
- RIPARIAN RIGHTS**  
Modernization and Improvement of New York's Riparian Law, W78-07410 6E  
Groundwater Law: The Riparian Problem, W78-07578 6E
- RIVER BASIN COMMISSION**  
Problem Identification and Ranking, An Assessment of a River Basin Planning Process, W78-07687 6B
- RIVER BASIN MANAGEMENT**  
Problem Identification and Ranking, An Assessment of a River Basin Planning Process, W78-07687 6B
- RIVER DANUBE (CZECHOSLOVAKIA)**  
Microbiological Aspects of Pollution and Self-Purification of the Water of the River Danube on its Czechoslovak Section (In German), W78-07267 5C
- RIVER FORECASTING**  
Derivation of Initial Soil Moisture Accounting Parameters from Soil Properties for the National Weather Service River Forecast System, W78-07551 2G
- RIVERS**  
Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado, W78-07356 5B  
Effluent Mixing Zone in a Shallow River, W78-07483 5B  
Sedimentation of River Navigation Channels, W78-07486 2J  
Computation of the Pattern of Currents in Rivers and Nonstratified Reservoirs, W78-07502 2E
- ROCKFILL DAMS**  
Effect of Nonlinear Air Filtration on Thermal Regime of Rock-Fill Dam, W78-07513 8D
- ROCKY MOUNTAIN REGION**  
Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Executive Summary), W78-07563 6G  
Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Final Report), W78-07567 6G  
Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Rocky Mountain Region Case Studies), W78-07568 6G
- ROOT DEVELOPMENT**  
Soil Strength and Soil Temperature: Their Effects on Root Growth of Tall Fescue, W78-07688 2G
- ROOT LENGTH TIP**  
Soil Strength and Soil Temperature: Their Effects on Root Growth of Tall Fescue, W78-07688 2G
- ROOT SYSTEMS**  
Hyacinths for Wastewater Treatment, W78-07442 5D
- ROOT ZONE**  
Theoretical and Experimental Observations of Water and Nitrate Movement Below a Crop Root Zone, W78-07615 5B
- ROOTED AQUATIC PLANTS**  
Hyacinths for Wastewater Treatment, W78-07442 5D
- ROTARY DRILLING**  
Flexodrill Monitors Borehole Continuously, W78-07579 8G
- ROTATING DISC COMPONENTS**  
Rotating Disc Sewage Treatment Systems for Suburban Developments and High-Density Resorts of Hawaii, W78-07393 5D
- RUBBER**  
Treatment of Some Industrial Effluents in Malaysia, W78-07602 5D
- RUBBER PIPES**  
Piping Materials: Little Furor; Some Change, W78-07414 8G
- RUNOFF**  
S-Hydrographs and Change of Unit Hydrograph Duration, W78-07385 2A
- SAKHALIN (USSR)**  
Investigation of Snow Control Systems on an Avalanche Slope, W78-07375 4A
- SALINE LAKES**  
The Problem of the Salinity Increase in Lake Qarun (Egypt) and a Proposed Solution, W78-07305 5C
- SALINE SOILS**  
Application of Modern Irrigation Technology in the Mesilla Valley, New Mexico, W78-07634 3C  
Modeling Salt Transport in the Irrigated Soils of Grand Valley, W78-07648 5B
- SALINE WATER**  
Minimizing Salt in Return Flow by Improving Irrigation Efficiency, W78-07616 5G
- SALINE WATER INTRUSION**  
Relationship Between Groundwater Resources and Energy Production in Southwestern Missouri, W78-07202 2K  
Dispersion of Proposed Effluent Discharges and Saltwater Intrusion in Cooper River; Hydraulic Model Investigation, W78-07670 5B
- SALINITY**  
Water Quality Model for the Upper North Platte River, W78-07206 5B
- The Impact of the 1975 Bonnet Carre Spillway Opening on Epifaunal Invertebrates in Southern Lake Pontchartrain, W78-07219 5C
- The Problem of the Salinity Increase in Lake Qarun (Egypt) and a Proposed Solution, W78-07305 5C
- Salinity: Its Definition and Calculation, W78-07367 2K
- Proceedings of National Conference: Irrigation Return Flow Quality Management, W78-07606 5G
- Modeling Salinity of Irrigation Return Flow Where Sources and Sinks are Present, W78-07617 5B
- Field Evaluation of Sprinkler Irrigation for Management of Irrigation Return Flow, W78-07618 5G
- Scientific Irrigation Scheduling for Salinity Control of Irrigation Return Flow, W78-07621 5G
- Areal Predictions of Soil Water Flux in the Unsaturated Zone, W78-07630 2G
- Hydro-Salinity Models: Sensitivity to Input Variables, W78-07632 5B
- The 1973 Agreement on Colorado River Salinity Between the United States and Mexico, W78-07643 6E
- Wellton-Mohawk On-Farm Systems Improvement Program, W78-07645 3C
- The Hydro-Salinity System in the Grand Valley, W78-07647 5G
- Evaluating Appropriate Technologies for Salinity Control in Grand Valley, W78-07649 5G
- Development of Best Management Practices for Salinity Control in Grand Valley, W78-07650 5G
- Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes Pugio: Importance of Free Cadmium Ion, W78-07662 5C
- Dispersion of Proposed Effluent Discharges and Saltwater Intrusion in Cooper River; Hydraulic Model Investigation, W78-07670 5B
- SALINITY CONTROL**  
Combining Agricultural Improvements and Desalting of Return Flows to Optimize Local Salinity Control Policies, W78-07628 5G
- SALMON**  
Temperature Requirements of Salmonids in Relation to Their Feeding, Bioenergetics, Growth and Behavior, W78-07322 5C
- SALMONID PRODUCTION**  
Temperature Requirements of Salmonids in Relation to Their Feeding, Bioenergetics, Growth and Behavior, W78-07322 5C

# SUBJECT INDEX

## SALMONID PRODUCTION

### SALT LOADING

Salt Loading in Disturbed Watershed-Field Study, W78-07484 5B

### SALTS

Salt Loading in Disturbed Watershed-Field Study, W78-07484 5B

Application of Modern Irrigation Technology in the Mesilla Valley, New Mexico, W78-07634 3C

The Hydro-Salinity System in the Grand Valley, W78-07647 5G

### SAMPLERS

Improved Under-Water Sampler for Limnological Work, W78-07276 7B

### SAMPLING

Oil Pollution Monitoring and Monitoring Unit, W78-07234 5A

Improved Under-Water Sampler for Limnological Work, W78-07276 7B

An In Situ Study of Recruitment, Growth and Survival of Subtidal Marine Algae: Techniques and Preliminary Results, W78-07308 5C

Sampling of Water and Wastewater, W78-07517 5A

A Coring and Squeezing Technique for the Detailed Study of Subsurface Water Chemistry, W78-07575 2K

### SAN JOAQUIN (CALIF)

How the NPDES Program Will Define Present Water Quality Conditions, W78-07637 5G

### SAN JOAQUIN VALLEY (CALIF)

Agricultural Drainage Problems of the San Joaquin Valley, W78-07636 4A

A Valleywide Solution--The Interagency Drainage Program, W78-07639 4A

### SAN LUIS RIVER BASIN (CALIF)

Economic Impact of Water Quality on River Basin Management, W78-07396 5G

### SANDS

Reclamation of Wastewater by Application on Land, W78-07519 5D

### SCREENS

Effluent Treatment Plant for the Smaller Community, W78-07428 5D

Operational Experience at the Borchers Quarry Wastewater Treatment Works, W78-07433 5D

The Design and Construction of the Martholme Regional Sewage-Treatment Works, W78-07477 5D

### SEA WATER

Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater, W78-07463 5F

A Preliminary Study of the Use of Benthic Algae as Biological Indicators of Heavy Metal Pollution in Sørkjorden, Norway, W78-07665 5A

### SEDIMENT THICKNESSES

Sediment Thicknesses, Eastern Lake Champlain, W78-07686 2J

### SEDIMENT TRANSPORT

Lined: A One Dimensional Multireach Sediment Transport Model, W78-07363 2J

### SEDIMENTATION

Model Tests of Circular Sewage Sedimentation Tanks, W78-07468 5D

The 1973 Bathymetric Survey in the New York Bight Apex: Maps and Geological Implications, W78-07548 2L

CIRIA Streamlines Tank Design, W78-07549 5D

### SEDIMENTS

A Study of Different Analytical Extraction Methods for Nondetril Heavy Metals in Aquatic Sediments, W78-07278 5A

The Impact of Nitrogen and Phosphorus Release from a Siliceous Sediment on the Overlying Water, W78-07302 5C

Composition of Suspensions and Sediments in the Estuaries of the Northern Dvina, Mezen', Pechora, and Ob' Rivers, W78-07405 2L

Use of Benthic Sediments as Indicators of Marina Flushing, W78-07553 5A

Management Guidelines for Controlling Sediments, Nutrients, and Adsorbed Biocides in Irrigation Return Flows, W78-07622 5G

On-Farm Method for Controlling Sediment and Nutrient Losses, W78-07626 5G

Economic Analysis of On-Farm Methods for Controlling Sediment and Nutrient Losses, W78-07627 5G

### SEEPAGE

A Variational Inequality Method Applied to Free Surface Seepage from a Triangular Ditch, W78-07390 4A

### SEICHES

Dynamics of Lake Onega Waters, W78-07501 2H

### SELF PURIFICATION

Microbiological Aspects of Pollution and Self-Purification of the Water of the River Danube on its Czechoslovak Section (In German), W78-07267 5C

The Effect of Chemicals on Some Microbial Self-Purification Processes in Bodies of Water (In Russian), W78-07298 5C

### SEPARATION TECHNIQUE

Removal of Chromium, Chromate, Molybdate and Zinc, W78-07231 5D

### SEPARATION TECHNIQUES

Element for Filtering and Separating Fluid Mixtures, W78-07240 5D

Process for Clarification of Oil-Containing Waste, W78-07248 5D

Device for Collecting Light-Weight Substances Floating on a Liquid Surface, W78-07253 5G

A Study of Different Analytical Extraction Methods for Nondetril Heavy Metals in Aquatic Sediments, W78-07278 5A

Filter Sack Dewatering, W78-07429 5D

Starch-Laden Effluent Treatment-A Case History, W78-07591 5D

The Recovery of Protein From Potato Juice Waste Water by Foam Separation, W78-07592 5D

Industrial Sludge and Animal Slurry De-Watering, W78-07657 5D

A Multi-Stage Filter Belt Press, W78-07666 5E

### SEPTIC TANKS

Sewage Treatment Equipment for Single Households to 5000 PE, W78-07439 5D

Travel of Microorganisms from a Septic Tile, W78-07469 5B

Modular Treatment Plant, W78-07659 5D

### SETTLING BASINS

Ductile-Iron Pipe Gallery, W78-07416 8G

Operational Experience at the Borchers Quarry Wastewater Treatment Works, W78-07433 5D

Sewage Treatment Equipment for Single Households to 5000 PE, W78-07439 5D

Buckland Pollution Control Centre Improves Environment in the South West, W78-07443 5D

Developments in Performance Relationships for Sewage, W78-07467 5D

Model Tests of Circular Sewage Sedimentation Tanks, W78-07468 5D

The Design and Construction of the Martholme Regional Sewage-Treatment Works, W78-07477 5D

# SUBJECT INDEX

SKYLAB

- CIRIA Streamlines Tank Design.  
W78-07549 5D
- Modular Treatment Plant.  
W78-07659 5D
- SEVIER VALLEY-PIUTE CANAL**  
Seepage Study of the Sevier Valley-Piute Canal, Sevier County, Utah,  
W78-07360 4A
- SEWAGE**  
History of Sewage Pumping in Britain,  
W78-07417 8C
- Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater,  
W78-07463 5F
- Model Tests of Circular Sewage Sedimentation Tanks,  
W78-07468 5D
- Pollution Control in the Baltic is Result of Cooperation.  
W78-07528 5G
- SEWAGE BACTERIA**  
Monitoring of Waters for *Bdellovibrio Bacteriovorus* - A Parasite of Gram Negative Enteric Bacteria Present in Sewage,  
W78-07323 5A
- Odor and Corrosion Control.  
W78-07430 5D
- New Procedure Determines Aerobic Sludge Stability,  
W78-07464 5D
- SEWAGE DISPOSAL**  
Missouri River Basin Sterol Assay Project Report. Coprostanol, A Positive Marker of Domestic and Run-Off Pollution: Sterol Assay of Wastewater Plant Effluents and Surface Waters of the Lower Main Stem Missouri,  
W78-07328 5A
- Mississippi River Basin Sterol Assay Project Report. Coprostanol, A Positive Molecular Marker of Domestic and Run-Off Sewage, Wastewater Plant Effluent and Surface Waters in the Burlington, Iowa Area on the Mississippi River,  
W78-07329 5A
- SEWAGE EFFLUENT**  
Data Report--Marsh/Pond System,  
W78-07338 5D
- SEWAGE EFFLUENTS**  
Nitrification in Four Acidic Streams in Southern New Jersey,  
W78-07353 5C
- Nutrient Distributions and Transport in Long Island Sound,  
W78-07550 5B
- Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent,  
W78-07655 5C
- SEWAGE LAGOONS**  
Water Hyacinths and Alligator Weeds for Final Filtration of Sewage,  
W78-07299 5D
- SEWAGE SLUDGE**  
A Test of the Effects of Domestic Sewage on the Growth of the Common Blue Mussel, *Mytilus Edulis*, in an Aquacultural System,  
W78-07205 5C
- Gamma Ray Treatment Reaps Harvest from Sewage.  
W78-07333 5D
- Belt Press Sludge Dewatering Machines.  
W78-07440 5D
- Medically Used Radionuclides in Sewage Sludge,  
W78-07460 5A
- A Multi-Stage Filter Belt Press.  
W78-07666 5E
- SEWAGE TREATMENT**  
Sewage Purification System,  
W78-07250 5D
- Pretreatment Filter Press Dewatering System,  
W78-07254 5D
- Hygienic Evaluation of Effectiveness of Urban Sewage Purification in Oxidation Ponds (In Russian),  
W78-07270 5D
- Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland,  
W78-07279 5C
- Restoration of Lower St. Regis Lake (Franklin County, New York),  
W78-07291 5G
- Water Hyacinths and Alligator Weeds for Final Filtration of Sewage,  
W78-07299 5D
- Rotating Disc Sewage Treatment Systems for Suburban Developments and High-Density Resorts of Hawaii,  
W78-07393 5D
- Hyacinths for Wastewater Treatment,  
W78-07442 5D
- Recent Advances in Ozone Technology,  
W78-07444 5D
- The Research Works on Sewage Treatment in Poland,  
W78-07531 5D
- Wastewater Treatment System.  
W78-07580 5D
- Sewage Treatment Rotary Distributor Range Extended.  
W78-07658 5D
- SEWERAGE**  
Sewers . . . The Cleaner, The Better.  
W78-07420 8G
- Alabama, (State Capital News),  
W78-07523 5D
- SEWERS**  
Piping Materials: Little Furor; Some Change.  
W78-07414 8G
- Hoscar's Extension Should Deodorize the Douglas,  
W78-07418 5D
- Sewers . . . The Cleaner, The Better.  
W78-07420 8G
- Grouting Provides Economical and Effective Maintenance in Kansas,  
W78-07421 8G
- SEX REVERSAL**  
Production of Monosex White Amur for Aquatic Plant Control,  
W78-07326 4A
- SHAD**  
Management of the Northern Chesapeake Bay American Shad Fishery,  
W78-07337 6B
- SHRIMP**  
Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, *Palaemonetes Pugio*: Importance of Free Cadmium Ion,  
W78-07662 5C
- A Comparative Study of the Effects of Mercuric Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, *Artemia Salina*,  
W78-07668 5C
- SIEVES**  
Starch-Laden Effluent Treatment-A Case History,  
W78-07591 5D
- SILTS**  
Reclamation of Wastewater by Application on Land,  
W78-07519 5D
- SIMULATION ANALYSIS**  
Water Quality Model for the Upper North Platte River,  
W78-07206 5B
- Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado,  
W78-07356 5B
- Comparison of Numerical Simulation Flow Models for Coastal Inlets,  
W78-07472 2L
- Simulation of Nitrogen Movement, Transformations, and Plant Uptake in the Root Zone,  
W78-07608 5B
- Practical Applications of Irrigation Return Flow Quality Models to Large Acreages,  
W78-07629 5G
- Water Distribution Patterns for Sprinkler and Surface Irrigation Systems,  
W78-07631 3F
- Hydro-Salinity Models: Sensitivity to Input Variables,  
W78-07632 5B
- Modeling the Irrigation Return Flow System--Current Capabilities and Future Needs,  
W78-07633 5G
- Modeling Salt Transport in the Irrigated Soils of Grand Valley,  
W78-07648 5B
- SIZING**  
Sizing of Containment Areas for Dredged Material,  
W78-07674 5E
- SKYLAB**  
Land Use and Environmental Assessment in the Central Atlantic Region,  
W78-07317 4A
- Visual Observations of Floating Ice from Skylab,  
W78-07346 2C



## SLUDGE

Operational Experience at the Borchers Quarry Wastewater Treatment Works, W78-07433 5D

## SLUDGE DIGESTION

Heat Treatment and Pressing of Digested Sludge, W78-07437 5D

## SLUDGE DISPOSAL

Sludge Disposal: The Problem, The Search, The Solution, W78-07424 5D

Treatment and Use of Sewage Purification Plant Sludges, W78-07425 5D

Effluent Treatment Plant for the Smaller Community, W78-07428 5D

The Thickening and Centrifuging of Sludge, W78-07436 5D

Los Angeles Faces Several Sludge Management Problems, W78-07448 5D

Plants and Systems for Composting of Sewage Sludges in the Federal Republic of Germany--State of the Art and Trends (Anlagen und Systeme zur Kompostierung von Abwässerschlaemmen in der Bundesrepublik Deutschland--Stand sowie Tendenzen), W78-07449 5E

Submission by the Institute of Water Pollution Control to the Royal Commission on Environmental Pollution on 'Environmental Pollution and Agriculture', W78-07473 5B

Marine Waste Disposal in the New York Bight--Public Policy, Environmental Impacts, and Alternative Futures, W78-07529 5E

Polish/U.S. Symposium on Wastewater Treatment and Sludge Disposal: Volume II, W78-07530 5D

## SLUDGE TREATMENT

Gamma Ray Treatment Reaps Harvest from Sewage, W78-07333 5D

Sludge Disposal: The Problem, The Search, The Solution, W78-07424 5D

Treatment and Use of Sewage Purification Plant Sludges, W78-07425 5D

The Use of Filterbelt Presses for Dewatering of Sewage Sludges, W78-07426 5D

Effluent Treatment Plant for the Smaller Community, W78-07428 5D

Filter Sack Dewatering, W78-07429 5D

The Thickening and Centrifuging of Sludge, W78-07436 5D

Sewage Sludge Lime Dosing and Filter Press Feeding, W78-07438 5D

Belt Press Sludge Dewatering Machines, W78-07440 5D

Los Angeles Faces Several Sludge Management Problems, W78-07448 5D

Plants and Systems for Composting of Sewage Sludges in the Federal Republic of Germany--State of the Art and Trends (Anlagen und Systeme zur Kompostierung von Abwässerschlaemmen in der Bundesrepublik Deutschland--Stand sowie Tendenzen), W78-07449 5E

Air vs 02: Two Activated Sludge Systems Compared, W78-07451 5D

Effect of Thermal Pretreatment on Digestibility and Dewaterability of Organic Sludges, W78-07457 5D

Polish/U.S. Symposium on Wastewater Treatment and Sludge Disposal: Volume II, W78-07530 5D

Industrial Sludge and Animal Slurry De-Watering, W78-07657 5D

Sewage Dewatering Plant for Small Communities, W78-07660 5D

Solids Dewatering, W78-07675 5E

## SLURRIES

Industrial Sludge and Animal Slurry De-Watering, W78-07657 5D

## SMALL WATERSHED PROGRAM

Effect of the Small Watershed Program on Major Uses of Land: Examination of 60 Projects in the Southeast, Mississippi Delta, and Missouri River Tributaries Regions, W78-07330 4D

## SMALL WATERSHEDS

Effect of the Small Watershed Program on Major Uses of Land: Examination of 60 Projects in the Southeast, Mississippi Delta, and Missouri River Tributaries Regions, W78-07330 4D

Rainfall and Runoff Data from Small Basins in Wyoming, W78-07349 7C

## SNAILS

Plant Species Diversity in a Marine Intertidal Community: Importance of Herbivore Food Preference and Algal Competitive Abilities, W78-07341 2L

## SNOW

Investigation of Snow Control Systems on an Avalanche Slope, W78-07375 4A

## SNOW MANAGEMENT

Investigation of Snow Control Systems on an Avalanche Slope, W78-07375 4A

## SODIUM COMPOUNDS

Preservation of Phenolic Compounds in Wastewaters, W78-07586 5D

## SOIL EROSION

Effect of the Small Watershed Program on Major Uses of Land: Examination of 60 Projects in the Southeast, Mississippi Delta, and Missouri River Tributaries Regions, W78-07330 4D

## SOIL INVESTIGATIONS

Areal Predictions of Soil Water Flux in the Unsaturated Zone, W78-07630 2G

## SOIL MOISTURE

Appendix E to Correlation of Dual-Channel Airborne IR Data with Soil Moisture Measurements, W78-07383 2G

Derivation of Initial Soil Moisture Accounting Parameters from Soil Properties for the National Weather Service River Forecast System, W78-07551 2G

## SOIL PHYSICAL PROPERTIES

Derivation of Initial Soil Moisture Accounting Parameters from Soil Properties for the National Weather Service River Forecast System, W78-07551 2G

## SOIL STRENGTH

Soil Strength and Soil Temperature: Their Effects on Root Growth of Tall Fescue, W78-07688 2G

## SOIL SURFACES

Protonation of Organic Bases in Clay-Water Systems, W78-07364 5B

## SOIL TEMPERATURE

Soil Strength and Soil Temperature: Their Effects on Root Growth of Tall Fescue, W78-07688 2G

## SOIL WATER

Multiple Tensiometer Flushing System, W78-07499 2G

## SOIL WATER MOVEMENT

Solute Transport Through Soil with Nonuniform Water Content, W78-07496 2G

Transient-And Steady-Flow Experiments Testing Theory of Water Flow in Saturated Bentonite, W78-07497 2G

Boundary Conditions in Modeling Water Flow in Unsaturated Soils, W78-07503 2G

Field Measured Flux of Volatile Denitrification Products as Influenced by Soil Water Content and Organic Carbon Source, W78-07613 5G

Theoretical and Experimental Observations of Water and Nitrate Movement Below a Crop Root Zone, W78-07615 5B

Areal Predictions of Soil Water Flux in the Unsaturated Zone, W78-07630 2G

## SOIL-WATER-PLANT RELATIONSHIPS

Soil Strength and Soil Temperature: Their Effects on Root Growth of Tall Fescue, W78-07688 2G

# SUBJECT INDEX

## STRIP MINE WASTES

### SOILS

Dielectric Constant and Electroconductance of Some Dry Frost-Prone Soils, W78-07369 2C

Dispersion in Soil Columns: Effect of Boundary Conditions and Irreversible Reactions, W78-07386 2G

Effects of Clay Type and Content, Exchangeable Sodium Percentage, and Electrolyte Concentration on Clay Dispersion and Soil Hydraulic Conductivity, W78-07498 2G

Boundary Conditions in Modeling Water Flow in Unsaturated Soils, W78-07503 2G

### SOLUTE

Steady-State Solute Convection in Two Dimensions with Nonuniform Infiltration, W78-07381 2G

### SOLUTES

Solute Transport Through Soil with Nonuniform Water Content, W78-07496 2G

### SONG BIRDS

Productivity of Red-Winged Blackbirds in Prairie Pothole Habitat, W78-07339 2I

### SORFJORDEN (NORWAY)

A Preliminary Study of the Use of Benthic Algae as Biological Indicators of Heavy Metal Pollution in Sorfjorden, Norway, W78-07665 5A

### SOUTH AFRICA

Variability of Hailstorms on the South African Plateau, W78-07507 2B

### SOUTH DAKOTA

The South Dakota Cooperative Land use Effort: A State Level Remote Sensing Demonstration Project, W78-07315 4A

### SOUTHERN NEW JERSEY STREAMS

Nitrification in Four Acidic Streams in Southern New Jersey, W78-07353 5C

### SPARTINA ALTERNIFLORA

Shoreline Plant Establishment and Use of a Wave-Stilling Device, W78-07230 2L

### SPAWNING

Northern Pike Production in Managed Spawning and Rearing Marshes, W78-07293 5C

### SPECIES COMPOSITION

Physical-Chemical Methods for the Control of Algal Species and Composition in Algal Culturing Facilities, W78-07324 5G

### SPECIFICATIONS

CIRIA Streamlines Tank Design, W78-07549 5D

### SPHAEROTILUS

Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent, W78-07655 5C

### SPRAYING

Submission by the Institute of Water Pollution Control to the Royal Commission on Environmental Pollution on 'Environmental Pollution and Agriculture', W78-07473 5B

### SPRINKLER IRRIGATION

Traveling Sprinkler Guide Wheel Assembly, W78-07244 3F

Submission by the Institute of Water Pollution Control to the Royal Commission on Environmental Pollution on 'Environmental Pollution and Agriculture', W78-07473 5B

Field Evaluation of Sprinkler Irrigation for Management of Irrigation Return Flow, W78-07618 5G

Effect of Irrigation Systems on Water Use Efficiency and Soil Water Solute Concentrations, W78-07620 5G

Water Distribution Patterns for Sprinkler and Surface Irrigation Systems, W78-07631 3F

### ST. VENANT EQUATIONS

Free Surface Flow Computations by Characteristics, W78-07493 2E

### STABILITY

New Procedure Determines Aerobic Sludge Stability, W78-07464 5D

### STANDING CROPS

Antecedent Event Influence on Benthic Marine Algal Standing Crops in Hawaii, W78-07295 2L

### STAPHYLOCOCCAL-ENTEROTOXIN B

Detoxification of Staphylococcal-Enterotoxin B in Water (In German), W78-07232 5F

### STARCHES

Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent, W78-07655 5C

### STATE GOVERNMENTS

State Agencies and Officials Responsible for Water Well Industry Codes and Licensing, W78-07573 6E

### STATISTICAL METHODS

Water/Wastewater Survey Guidelines, W78-07522 5A

### STATISTICS

NWWA's Most Requested Statistics, W78-07582 8A

### STEAMBOAT SPRINGS (COLO)

Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado, W78-07356 5B

### STEEL PIPES

GRP Pipe for Sewage Discharge at Sea, W78-07415 8G

Sewage System Rejuvenation, W78-07535 8G

### STORM DRAINS

Grouting Provides Economical and Effective Maintenance in Kansas, W78-07421 8G

### STORM RUNOFF

Dallas Urban Runoff, Storm of February 11, 1977, W78-07361 2B

### STORM SURGE

Nearshore Numerical Storm Surge and Tidal Simulation, W78-07679 8B

### STORM WATER

National Needs for Combined Sewer Overflow Control, W78-07422 5D

### STORMS

Variability of Hailstorms on the South African Plateau, W78-07507 2B

### STRAIT OF JUAN DE FUCA

Nearshore Fish and Macroinvertebrate Assemblages Along the Strait of Juan de Fuca Including Food Habits of Nearshore Fish, W78-07543 2L

### STRATIFICATION

Forced Plumes in a Stratified Reservoir, W78-07489 8B

### STREAM EROSION

Scour and Fill in Steep, Sand-Bed Ephemeral Streams, W78-07379 2J

### STREAM FUNCTION

Linear and Nonlinear Wave Action Estimates, W78-07485 2L

### STREAMFLOW

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1977 Water Year, W78-07345 4A

Technique for Estimating Magnitude and Frequency of Floods in Illinois, W78-07350 4A

Generation of Ungaged Streamflow Data, W78-07384 2A

Nonstationarity of the Mean and the Hurst Phenomenon, W78-07388 2E

Some Properties of Variance Reduction Techniques Where Hydrological Extremes Are Estimated by Monte Carlo Simulation, W78-07391 2E

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Pacific Northwest Region Case Studies), W78-07569 6G

### STREAMS

Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut, W78-07334 5A

Unsteady-State Water-Quality Model, W78-07348 5B

The Dishonest Method in Stream Temperature Modeling, W78-07392 2D

### STRIP MINE WASTES

Effects of Wetting Agents on Water Infiltration into Water-Repellent Coal Mine Spoils, W78-07370 5G

# SUBJECT INDEX

## STRIP MINE WASTES

### STRUCTURAL BEHAVIOR

- PVC Pipe Passes Performance and Cost Tests, W78-07479 8G

### SUB-SEALED DISPOSAL

- Sub-Sealed Disposal of Radioactive Waste: Prevention or Management, W78-07536 5E

### SUBMERGED PLANTS

- Distribution, Growth, and Phosphorus Relationships of Myriophyllum Heterophyllum Michx. in Lake Winnepesaukee, New Hampshire, W78-07482 5C

### SUBSURFACE IRRIGATION

- Effect of Irrigation Systems on Water Use Efficiency and Soil Water Solute Concentrations, W78-07620 5G

### SUCCESSION

- Patterns of Succession in Benthic Infaunal Communities Following Dredging and Dredged Material Disposal in Monterey Bay, W78-07677 5C

### SUGAR CROPS

- Biological Purification of Sugar Works Waste Water--Includes Neutralization with Lime and Inoculation with Chlorella Culture Using Light and Carbon Dioxide, W78-07259 5D

### SUGARBEETS

- Microbiological Aspects of Pollution and Self-Purification of the Water of the River Danube on its Czechoslovak Section (In German), W78-07267 5C

### SULFATES

- Treatment of Water to Remove Certain Ions Therefrom, W78-07246 5F  
Characterization of Sulphate Uptake in Anacystis Nidulans, W78-07304 5C

### SULFIDES

- Odor and Corrosion Control, W78-07430 5D

### SULFITE LIQUORS

- Biologically Purifying Waste Water in Air Tank--Using Extract of Excess Active Slime as Biostimulator, W78-07255 5D

- Concentration of Acetic Acid in Sulfite Pulp Evaporation Drain by Reverse Osmosis, W78-07598 5D

### SULFONATES

- Effects of Wetting Agents on Water Infiltration into Water-Repellent Coal Mine Spoils, W78-07370 5G

### SULFUR CREEK PROJECT (WASH)

- The Sulphur Creek Pilot Project: A Practical Approach to Control of Pollutants Leaving Irrigated Farmlands, W78-07641 5G

### SUNFISHES

- Use of Zooplanktophagic Fishes in Channel Catfish Production Ponds, W78-07292 5C

### SURFACE ACIDITY

- Protonation of Organic Bases in Clay-Water Systems, W78-07364 5B

### SURFACE CHEMISTRY

- Protonation of Organic Bases in Clay-Water Systems, W78-07364 5B

### SURFACE CURRENTS

- Surface Drifter Movements Observed in Outer Strait of Juan de Fuca, July 1977, W78-07545 5B

- Surface Currents as Determined by Drift Card Releases Over the Continental Shelf Off Central and Southern California, W78-07556 5B

### SURFACE-GROUNDWATER RELATIONSHIPS

- Preliminary Digital Model of the Arikaree Aquifer in the Sweetwater River Basin, Central Wyoming, W78-07351 2F

### SURFACE IRRIGATION

- Effects of Irrigation Management on Soil Salinity and Return Flow Quality, W78-07619 5G

### SURFACE WATERS

- Index of Surface-Water Stations in Texas, October 1977, W78-07312 7C

- Water Resources Data for Minnesota, Water Year 1976, W78-07313 7C

- Water Resources Data for Arkansas, Water Year 1976, W78-07314 7C

- Water Resources of the Weiser River Basin, West-Central Idaho, W78-07342 4A

- Surface Currents as Determined by Drift Card Releases Over the Continental Shelf Off Central and Southern California, W78-07556 5B

### SURFACES

- Protonation of Organic Bases in Clay-Water Systems, W78-07364 5B

### SURFACTANTS

- Effects of Wetting Agents on Water Infiltration into Water-Repellent Coal Mine Spoils, W78-07370 5G

### SURVEYING INSTRUMENTS

- Positioning Techniques and Equipment for U. S. Army Corps of Engineers Hydrographic Surveys, W78-07676 7B

### SURVEYS

- Water/Wastewater Survey Guidelines, W78-07522 5A

### SUSPENDED LOAD

- Linsed: A One Dimensional Multireach Sediment Transport Model, W78-07363 2J

### SUSPENDED MATTER

- Suspended-Matter Distribution in the New York Bight Apex Related to Hurricane Belle, W78-07509 2L

### SUSPENDED SOLIDS

- Land Use and Pollution Patterns on the Great Lakes, W78-07288 5B

- Composition of Suspensions and Sediments in the Estuaries of the Northern Dvina, Mezen, Pechora, and Ob' Rivers, W78-07405 2L

- Suspended-Matter Distribution in the New York Bight Apex Related to Hurricane Belle, W78-07509 2L

- Evaluation of Surface Irrigation Return Flows in the Central Valley of California, W78-07624 5B

### SUSQUEHANNA RIVER

- Floodplain Delineation Using LANDSAT-1 Data, W78-07510 4A

### SWEDEN

- Eulimnion, an Original Place of New Forms, W78-07285 5C

- Urban Hydrological Modeling and Catchment Research in Sweden, W78-07695 2A

### SWEETWATER RIVER BASIN (WYO)

- Preliminary Digital Model of the Arikaree Aquifer in the Sweetwater River Basin, Central Wyoming, W78-07351 2F

### SYNTHETIC HYDROLOGY

- Flood-Hazard Study--100-Year Flood Stage for Lucerne Lake, San Bernardino County, California, W78-07359 4A

- Generation of Ungaged Streamflow Data, W78-07384 2A

- Some Properties of Variance Reduction Techniques Where Hydrological Extremes Are Estimated by Monte Carlo Simulation, W78-07391 2E

### TANNERY WASTES

- Polish/U.S. Symposium on Wastewater Treatment and Sludge Disposal: Volume II, W78-07530 5D

- Treatment of Some Industrial Effluents in Malaysia, W78-07602 5D

### TECHNETIUM

- Role of Plankton in the Behavior of TC99 and MN54 in Seawater, W78-07286 5C

### TECHNOLOGY

- Evaluating Appropriate Technologies for Salinity Control in Grand Valley, W78-07649 5G

- A Process for Identifying, Evaluating and Implementing Solutions for Irrigation Return Flow Problems, W78-07654 5G

### TECHNOLOGY TRANSFER

- Handbook-Index of Hawaii Groundwater and Resources Data, Extracted from Reports of the Water Resources Research Center, University of Hawaii, Volume I, W78-07395 7C

### TELEMETRY

- Flexodrill Monitors Borehole Continuously, W78-07579 8G



# SUBJECT INDEX

## TRACE ELEMENTS

### TEMPERATURE

Temperature Regime of Low-Head Earth Dams in Central Yakutia, W78-07512 8D

Effect of Nonlinear Air Filtration on Thermal Regime of Rock-Fill Dam, W78-07513 8D

Calculations of the Thermal Regime of Earthen Dams Considering Their Construction by Layers, W78-07514 8D

### TENSIMETERS

Multiple Tensiometer Flushing System, W78-07499 2G

### TERTIARY TREATMENT

Recent Advances in Ozone Technology, W78-07444 5D

Lawton Advanced Wastewater Treatment Plant, W78-07452 5D

Future Treatment Plant Requirements, W78-07474 5D

Landmark Texas Decision Agrees Benefit is not Worth the Cost, W78-07475 5G

### TEST WELLS

Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico, W78-07352 8B

### TESTING PROCEDURES

An In Situ Study of Recruitment, Growth and Survival of Subtidal Marine Algae: Techniques and Preliminary Results, W78-07308 5C

### TEXAS

Index of Surface-Water Stations in Texas, October 1977, W78-07312 7C

Dallas Urban Runoff, Storm of February 11, 1977, W78-07361 2B

Effect of Irrigation Systems on Water Use Efficiency and Soil Water Solute Concentrations, W78-07620 5G

### TEXAS GULF INTRACOASTAL WATERWAY

Environmental Considerations Relating to Operation and Maintenance of the Texas Gulf Intracoastal Waterway, W78-07538 2L

### TEXTILES

Polish/U.S. Symposium on Wastewater Treatment and Sludge Disposal: Volume II, W78-07530 5D

Adsorption of Textile Dyes by Activated Carbon Produced from Agricultural, Municipal and Industrial Wastes, W78-07599 5D

Dye Waste Treatment and Reuse, W78-07600 5D

Chrome Dyeing of Wool: Reducing the Amount of Chromium in the Residual Bath, W78-07601 5D

Treatment of Some Industrial Effluents in Malaysia, W78-07602 5D

### THEORETICAL ANALYSIS

Theory and Numerical Analysis of Moving Boundary Problems in the Hydrodynamics of Porous Media, W78-07389 2F

### THERMAL POLLUTION

Temperature Requirements of Salmonids in Relation to Their Feeding, Bioenergetics, Growth and Behavior, W78-07322 5C

Adaptation of Copepod Populations to Thermal Stress, II, W78-07398 5C

Effluent Mixing Zone in a Shallow River, W78-07483 5B

Prediction of Temperature Due to Heated Discharges, W78-07495 5B

Model Study of Cool Water Discharge from Proposed LNG Facility, Los Angeles Harbor, California, W78-07669 5B

### THERMAL POWER

Hot Dry Rock Geothermal Energy Development Project: Annual Report, Fiscal Year 1977, W78-07572 8B

### THERMAL POWERPLANTS

Prediction of Temperature Due to Heated Discharges, W78-07495 5B

### THERMAL RADIATION

Effect of Thermal Pretreatment on Digestibility and Dewaterability of Organic Sludges, W78-07457 5D

### THERMAL REGIME (DAMS)

Calculations of the Thermal Regime of Earthen Dams Considering Their Construction by Layers, W78-07514 8D

### THERMAL STRATIFICATION

The Effects of Diurnal Mixing on Thermal Stratification of Static Impoundments, W78-07210 2H

### THERMAL STRESS

Adaptation of Copepod Populations to Thermal Stress, II, W78-07398 5C

### THERMAL TOLERANCE

Adaptation of Copepod Populations to Thermal Stress, II, W78-07398 5C

### TIDAL CURRENTS

Generation of Tidal Current and Height Charts for Narragansett Bay Using a Numerical Model, W78-07555 2L

### TIDAL EFFECTS

Photorespiration in Larger Littoral Algae, W78-07274 5C

Surface Drifter Movements Observed in Outer Strait of Juan de Fuca, July 1977, W78-07545 5B

### TIDAL HEIGHT CHARTS

Generation of Tidal Current and Height Charts for Narragansett Bay Using a Numerical Model, W78-07555 2L

### TIDAL INLETS

Improvements for Little River Inlet, South Carolina: Hydraulic Model Investigation, W78-07671 8B

### TIDAL MARSHES

Tidal Marsh Bibliography, Selected Key Work Index (Partially Annotated), W78-07226 2L

Delineation of Tidal Wetlands Boundaries in Lower Chesapeake Bay and its Tributaries, W78-07229 2L

Northumberland County Tidal Marsh Inventory, W78-07311 2L

### TIDAL WATERS

An In Situ Study of Recruitment, Growth and Survival of Subtidal Marine Algae: Techniques and Preliminary Results, W78-07308 5C

### TIDES

Generation of Tidal Current and Height Charts for Narragansett Bay Using a Numerical Model, W78-07555 2L

Nearshore Numerical Storm Surge and Tidal Simulation, W78-07679 8B

### TILE DRAINS

Travel of Microorganisms from a Septic Tile, W78-07469 5B

### TOTAL ORGANIC CARBON

Determination of Total Organic Carbon in Potable Water, Sewage, Industrial Effluents, and Boiler Feed Water, W78-07404 5A

### TOXICITY

Studies on the Toxicity of Ammonia, Nitrate and their Mixtures to Guppy Fry, W78-07214 5C

Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes pugio: Importance of Free Cadmium Ion, W78-07662 5C

Trace Metal-Chelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations, W78-07663 5C

Copper Sensitivity of Gonyaulax tamarensis, W78-07664 5C

A Comparative Study of the Effects of Mercuric Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, Artemia salina, W78-07668 5C

### TOXINS

Total Organic Halogen as Water Quality Parameter: Adsorption/Microcoulometric Method, W78-07273 5A

### TRACE ELEMENTS

Determination of Trace Elements in the English Coulee System: Presence Due to Extended Lignite Burning, W78-07208 5A

# SUBJECT INDEX

## TRACE ELEMENTS

A New Dialysis-Ion Exchange Technique for Determining the Forms of Trace Metals in Water, W78-07277 5A

## TRACE ORGANIC CONTAMINANTS

The Role of Surface Microlayer of Water in the Distribution and Fate of Trace Organic Contaminants; A Feasibility Study, W78-07319 5B

## TRACERS

Groundwater Tracing with Post Sampling Activation Analysis Using Bromide and Iodide Ions Injected Simultaneously into a Shallow-Well System, W78-07683 5B

## TRANSLOCATION

Role of Plankton in the Behavior of TC99 and MN54 in Seawater, W78-07286 5C

## TRANSMITTERS

Investigation of Remote Water-Quality Monitoring Systems for Use With GOES or ERTS Water Data Transmitter, W78-07678 5A

## TREADDUR BAY (UNITED KINGDOM)

Photorespiration in Larger Littoral Algae, W78-07274 5C

## TREATMENT FACILITIES

New System Cuts Phosphorus for Less Cost, W78-07301 5D

Alum Treatment of High-Rate Trickling Filter Effluent at Chapel Hill, North Carolina, W78-07409 5D

Ductile-Iron Pipe Gallery, W78-07416 8G

Hoscar's Extension Should Deodorize the Douglas, W78-07418 5D

Problems Encountered in the Up-Grading of Some Small Sewage Works, W78-07427 5D

Buckland Pollution Control Centre Improves Environment in the South West, W78-07443 5D

Los Angeles Faces Several Sludge Management Problems, W78-07448 5D

Lawton Advanced Wastewater Treatment Plant, W78-07452 5D

Landmark Texas Decision Agrees Benefit is not Worth the Cost, W78-07475 5G

The Design and Construction of the Martholme Regional Sewage-Treatment Works, W78-07477 5D

Night Soil Treatment by 'Denipac Process'--Kawamuko Treatment Plant, Matsue City (2), (Denipakku puroseshu ni yoru shinyo shori-matsue shi kawamuko shorijo), W78-07478 5D

Capacity Planning for Regional Wastewater Treatment Systems, W78-07521 5D

Alabama, (State Capital News), W78-07523 5D

Instrumentation and Automation in Water and Wastewater Treatment, W78-07525 5A

Pollution Control in the Synthetic Resins Industry, W78-07587 5D

Modular Treatment Plant, W78-07659 5D

Sewage Dewatering Plant for Small Communities, W78-07660 5D

## TRENCHES

PVC Pipe Passes Performance and Cost Tests, W78-07479 8G

## TRICKLE IRRIGATION

Effects of Irrigation Management on Soil Salinity and Return Flow Quality, W78-07619 5G

## TRICKLING FILTERS

Performance of a Trickling Filter, Solids Removal, and Anaerobic Digestion System for Recycled Poultry Manure Wastewater, W78-07207 5D

Alum Treatment of High-Rate Trickling Filter Effluent at Chapel Hill, North Carolina, W78-07409 5D

## TROPHIC LEVEL

Nitrogen Transformation in Lakes, W78-07262 5C

The Relation Between Adenosine Triphosphate and Microbial Biomass in Diverse Aquatic Ecosystems, W78-07306 5C

## TROUT

Temperature Requirements of Salmonids in Relation to Their Feeding, Bioenergetics, Growth and Behavior, W78-07322 5C

## TUBIFICIDS

Macrobenthos of the Tidal Delaware River Between Trenton and Burlington, New Jersey, W78-07300 5C

## TUNNEL CONSTRUCTION

Boring Machines Pick Up Speed on Deep Chicago Sewer Tunnels, W78-07423 8C

## TUNNELING MACHINES

Boring Machines Pick Up Speed on Deep Chicago Sewer Tunnels, W78-07423 8C

## TURBINES

Wind Powered Artificial Aeration of Northern Prairie Lakes, W78-07201 8C

## U-234/238 ALPHA-ACTIVITY RATIO

Uranium-Isotope Variations in Groundwaters of the Floridan Aquifer and Boulder Zone of South Florida, W78-07343 5B

## ULTRAVIOLET RADIATION

The Background to, and the Application of, Laboratory Instrumentation to Water Analysis, W78-07458 5A

## UNGAGED WATERSHEDS

Generation of Ungaged Streamflow Data, W78-07384 2A

## UNIT HYDROGRAPH

S-Hydrographs and Change of Unit Hydrograph Duration, W78-07385 2A

## UNITED KINGDOM

Urban Hydrological Modeling and Catchment Research in the United Kingdom, W78-07698 2A

## UNITED STATES

State Agencies and Officials Responsible for Water Well Industry Codes and Licensing, W78-07573 6E

Water Well Industry Codes and Licensing, W78-07574 6E

Urban Hydrological Modeling and Catchment Research in the U.S.A., W78-07700 2A

## UNSATURATED SOILS

Boundary Conditions in Modeling Water Flow in Unsaturated Soils, W78-07503 2G

## UNSTEADY FLOW

Unsteady-State Water-Quality Model, W78-07348 5B

Free Surface Flow Computations by Characteristics, W78-07493 2E

## UPPER MISSISSIPPI RIVER BASIN

### COMMISSION

Problem Identification and Ranking, An Assessment of a River Basin Planning Process, W78-07687 6B

## UPWELLING

Annual Fluctuations in Biomass of Taxonomic Groups of Zooplankton in the California Current, W78-07275 5C

## URANIUM RADIOISOTOPES

Uranium-Isotope Variations in Groundwaters of the Floridan Aquifer and Boulder Zone of South Florida, W78-07343 5B

## URBAN HYDROLOGY

Urban Hydrological Modeling and Catchment Research: International Summary, W78-07689 2A

Urban Hydrological Modeling and Catchment Research in India, W78-07690 2A

Urban Runoff Research in Poland, W78-07691 2A

Urban Hydrological Modeling and Catchment Research in the Netherlands, W78-07692 2A

Urban Hydrological Modeling and Catchment Research in Norway, W78-07693 2A

Urban Hydrological Modeling and Catchment Research in France, W78-07694 2A

Urban Hydrological Modeling and Catchment Research in Sweden, W78-07695- 2A

Urban Hydrology Studies and Mathematical Modeling in the Federal Republic of Germany, W78-07696 2A

# SUBJECT INDEX

## WASTE DISPOSAL

- Methods for Calculating Maximum Flood Discharges for Natural Watercourses and Urban Areas in the U.S.S.R., W78-07697 2A
- URBAN RUNOFF**
- Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut, W78-07334 5A
- Urban Runoff Pollution Control--State-of-the-Art, W78-07335 5G
- Dallas Urban Runoff, Storm of February 11, 1977, W78-07361 2B
- Transformation of the Hydrologic Budget of the Moscow City Area, W78-07376 4C
- Urban Runoff Research in Poland, W78-07691 2A
- Urban Hydrological Modeling and Catchment Research in the Netherlands, W78-07692 2A
- URBAN WATERSHEDS**
- Urban Hydrological Modeling and Catchment Research in Australia, W78-07699 2A
- URBANIZATION**
- The Relationship of Lake Quality to Specific Urbanization Stresses, W78-07204 5C
- Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut, W78-07334 5A
- Transformation of the Hydrologic Budget of the Moscow City Area, W78-07376 4C
- Urban Hydrological Modeling and Catchment Research in India, W78-07690 2A
- USSR**
- Analysis of Intense Precipitation in the Krasnoyarsk Area, W78-07374 2B
- Transformation of the Hydrologic Budget of the Moscow City Area, W78-07376 4C
- Composition of Suspensions and Sediments in the Estuaries of the Northern Dvina, Mezen', Pechora, and Ob' Rivers, W78-07405 2L
- Investigation of Level Fluctuations in Closed Bodies of Water on the Basis of Stochastic Models of the Elements of the Hydrologic Budget, W78-07500 2E
- Dynamics of Lake Onega Waters, W78-07501 2H
- Dam of the Kolyma Hydroelectric Power Plant, W78-07511 8D
- Temperature Regime of Low-Head Earth Dams in Central Yakutia, W78-07512 8D
- Methods for Calculating Maximum Flood Discharges for Natural Watercourses and Urban Areas in the U.S.S.R., W78-07697 2A
- UTAH**
- Seepage Study of the Sevier Valley-Piute Canal, Sevier County, Utah, W78-07360 4A
- Field Evaluation of Sprinkler Irrigation for Management of Irrigation Return Flow, W78-07618 5G
- VADOSE WATER**
- Monitoring in the Zone of Aeration, W78-07470 5A
- VALVES**
- Self Cleaning, Pressure Responsive Emitter Valve for Soil Irrigation, W78-07243 3F
- VANADATE IONS**
- Suggested Method for Vanadate Removal from Mill Effluents, W78-07332 5D
- VANADIUM**
- Suggested Method for Vanadate Removal from Mill Effluents, W78-07332 5D
- VARIABILITY**
- Variability of Hailstorms on the South African Plateau, W78-07507 2B
- Variability of Nitrate Leaching Within Defined Management Units, W78-07612 5B
- Evaluation of Surface Irrigation Return Flows in the Central Valley of California, W78-07624 5B
- VARIABLE DISCHARGE**
- Flow to a Nonpenetrating Well in a Leaky Artesian Aquifer with Variable Discharge, W78-07378 2F
- VARIANCE REDUCTION**
- Some Properties of Variance Reduction Techniques Where Hydrological Extremes Are Estimated by Monte Carlo Simulation, W78-07391 2E
- VEGETATION ESTABLISHMENT**
- Shoreline Plant Establishment and Use of a Wave-Stilling Device, W78-07230 2L
- VERMONT**
- Sediment Thicknesses, Eastern Lake Champlain, W78-07686 2J
- VIRGINIA**
- City of Newport News and Fort Eustis Tidal Marsh Inventory, W78-07224 2L
- York County and Town of Poquoson Tidal Marsh Inventory, W78-07310 2L
- Northumberland County Tidal Marsh Inventory, W78-07311 2L
- VIRUS REMOVAL (WATER)**
- Viruses in Water: The Increasing Urgency of the Problem and Approaches to its Solution (In Russian), W78-07261 5G
- VIRUSES**
- Viruses in Water: The Increasing Urgency of the Problem and Approaches to its Solution (In Russian), W78-07261 5G
- Stability in Drinking and Surface Water of Nine Virus Species from Different Genera (In German), W78-07272 5C
- The Effect of Chemicals on Some Microbial Self-Purification Processes in Bodies of Water (In Russian), W78-07298 5C
- The Dangers of Inadequate Chlorination of Polluted Waters, W78-07435 5D
- The Behavior of F2 Coliphage in Activated Sludge Treatment, W78-07461 5D
- Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater, W78-07463 5F
- Recycling of Water for Irrigation: Persistence of Enteroviruses in Sewage Effluent and Natural Waters Receiving the Effluent, W78-07471 5B
- Virion Aggregation and Disinfection of Water Viruses by Bromine, W78-07524 5F
- Nutrient, Bacterial, and Virus Control as Related to Ground Water Contamination, W78-07571 5B
- WALES**
- Water Resources and Climatic Change, W78-07380 2A
- WALKER DAM IMPOUNDMENT (VA)**
- Final Environmental Statement for Walker Dam Impoundment, Aquatic Plant Control Project, New Kent County, Virginia, W78-07403 6G
- WASHINGTON**
- Irrigation Return Flow Problems in Yakima Valley, W78-07640 5G
- The Sulphur Creek Pilot Project: A Practical Approach to Control of Pollutants Leaving Irrigated Farmlands, W78-07641 5G
- The '208' Planning Effort for Irrigated Agriculture in the State of Washington, W78-07642 5G
- WASTE ASSIMILATIVE CAPACITY**
- Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado, W78-07356 5B
- WASTE DISPOSAL**
- Pollution in the Northeast Pacific Ocean, W78-07325 5B



# SUBJECT INDEX

## WASTE DISPOSAL

Sub-Seabed Disposal of Radioactive Waste: Prevention or Management, W78-07536 5E

Technical and Philosophical Aspects of Ocean Disposal, W78-07540 5E

Water Quality. MESA New York Bight Atlas Monograph 27, W78-07542 5B

Industrial Wastes, MESA New York Bight Atlas Monograph 30, W78-07547 5B

The 1973 Bathymetric Survey in the New York Bight Apex: Maps and Geological Implications, W78-07548 2L

## WASTE DISPOSAL SITES

Sizing of Containment Areas for Dredged Material, W78-07674 5E

Feasibility of Inland Disposal of Dewatered Dredged Material: A Literature Review, W78-07682 5E

## WASTE DISPOSAL WELLS

The Use of Galerkin Finite-Element Methods to Solve Mass-Transport Equations, W78-07354 5B

## WASTE WATER DISPOSAL

Make Wastewater More Versatile: Reuse it for Recreation Lakes, W78-07217 5D

Pollution Control in the Baltic is Result of Cooperation, W78-07528 5G

Marine Waste Disposal in the New York Bight-Public Policy, Environmental Impacts, and Alternative Futures, W78-07529 5E

Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent, W78-07655 5C

## WASTE WATER TREATMENT

Performance of a Trickling Filter, Solids Removal, and Anaerobic Digestion System for Recycled Poultry Manure Wastewater, W78-07207 5D

Removal of Color from Paper Mill Waste Waters, W78-07238 5D

Element for Filtering and Separating Fluid Mixtures, W78-07240 5D

Method for Clarifying Waste Water Containing Finely Divided Oily Materials, W78-07245 5D

Method for Purification of Industrial Waste Water, W78-07247 5D

Process for Clarification of Oil-Containing Waste, W78-07248 5D

Process for Treating Wool Scouring Wastes, W78-07249 5D

Sewage Purification System, W78-07250 5D

Water Purifying Device Without Movable Mechanical Part in Contact with the Liquid to be Treated, W78-07252 5D

Pretreatment Filter Press Dewatering System, W78-07254 5D

Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland, W78-07279 5C

New System Cuts Phosphorus for Less Cost, W78-07301 5D

Particle Disruption in Flocculating Systems, W78-07321 5F

Suggested Method for Vanadate Removal from Mill Effluents, W78-07332 5D

Rotating Disc Sewage Treatment Systems for Suburban Developments and High-Density Resorts of Hawaii, W78-07393 5D

Alum Treatment of High-Rate Trickling Filter Effluent at Chapel Hill, North Carolina, W78-07409 5D

Effect of Time of Deacetylation on Molecular Weight Distribution, Acetyl Content, Viscosity, and Performance of Chitsan as a Conditioning Agent for Activated Sludge, W78-07552 5D

Reuse of Municipal Wastewater for Groundwater Recharge, W78-07570 5D

## WATER ALLOCATION (POLICY)

Administrative Practice and Procedure Under Permit Systems, W78-07411 6E

## WATER ANALYSIS

Nitrification in Four Acidic Streams in Southern New Jersey, W78-07353 5C

A Coring and Squeezing Technique for the Detailed Study of Subsurface Water Chemistry, W78-07575 2K

## WATER BIRDS

Investigation of Oil Pollution on the Polish Baltic Coast in 1974/1975 (In Polish), W78-07265 5B

## WATER BUDGET

Groundwater Recharge and Coastal Discharge for the Northwest Coast of the Island of Hawaii: A Computerized Water Budget Approach, W78-07394 2F

## WATER CHEMISTRY

pH Averaging, W78-07456 5A

## WATER CONTROL

Moisture Sensing Apparatus and Method, W78-07242 3F

## WATER COSTS

Economic Impact of Water Quality on River Basin Management, W78-07396 5G

## WATER HYACINTH

Water Hyacinths and Alligator Weeds for Final Filtration of Sewage, W78-07299 5D

Hyacinths for Wastewater Treatment, W78-07442 5D

## WATER LAW

Case Note: Water and Water Courses -- Limiting the Reservation Doctrine. Mimbres Valley Irrigation Co. v. Salopek, 564 P.2d 615 (N.M.1977), cert.granted, 46 U.S.L.W. 3426 (No.77-510), W78-07211 6E

Modernization and Improvement of New York's Riparian Law, W78-07410 6E

Interface of Water Quantity and Quality Laws in the West, W78-07652 6E

## WATER LEVEL FLUCTUATIONS

Water-Level Changes in Wells Along the West Side of the Cedar Creek Anticline, Southeastern Montana, W78-07357 4B

Investigation of Level Fluctuations in Closed Bodies of Water on the Basis of Stochastic Models of the Elements of the Hydrologic Budget, W78-07500 2F

Dynamics of Lake Onega Waters, W78-07501 2H

## WATER LEVELS

Description of Wells at Beale Air Force Base and Vicinity, California, W78-07358 4B

Development of a Two Dimensional Hydrodynamic Numerical Model for Use in a Shallow, Well-Mixed Estuary, W78-07408 2L

## WATER MANAGEMENT (APPLIED)

Evaluation of the Cost-Effectiveness of Non-structural Pollution Controls: A Manual for Water Quality Management Planning, W78-07336 5G

Proceedings of National Conference: Irrigation Return Flow Quality Management, W78-07606 5G

Nitrogen and Water Management to Minimize Return-Flow Pollution from Potato Fields of the Columbia Basin, W78-07611 5G

## WATER POLICY

General Adjudication Proceedings, W78-07412 6E

An Influent Control Approach to Irrigation Return Flow Quality Management, W78-07653 5G

## WATER POLLUTION

Innovative Management Concept for 208 Planning, W78-07222 5G

Dye Infusion Technique Assesses Stream Pollution in Ohio, W78-07373 5B

Two-Dimensional Plume in Uniform Groundwater Flow, W78-07490 5B

# SUBJECT INDEX

## WATER QUALITY

Evaluation of Water Quality of Puget Sound and Hood Canal in 1976, W78-07544 5C

An Evaluation of Oil and Grease Contamination Associated with Dredged Material Containment Areas, W78-07681 5G

### WATER POLLUTION CONTROL

Method of Average Birth and Death Rate Evaluation in the Marine-Terrestrial Bacteria Interactions, W78-07263 5C

Total Organic Halogen as Water Quality Parameter: Adsorption/Microcoulometric Method, W78-07273 5A

A Generalized Water Quality Model for Eutrophic Lakes and Reservoirs, W78-07290 5C

The Problem of the Salinity Increase in Lake Qarun (Egypt) and a Proposed Solution, W78-07305 5C

Suggested Method for Vanadate Removal from Mill Effluents, W78-07332 5D

Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut, W78-07334 5A

Urban Runoff Pollution Control--State-of-the-Art, W78-07335 5G

Evaluation of the Cost-Effectiveness of Non-structural Pollution Controls: A Manual for Water Quality Management Planning, W78-07336 5G

Landmark Texas Decision Agrees Benefit is not Worth the Cost, W78-07475 5G

Pollution Control in the Baltic is Result of Cooperation, W78-07528 5G

Nitrate Movement in Clay Soils and Methods of Pollution Control, W78-07609 5B

### WATER POLLUTION EFFECTS

Marine Pollution Hazards, W78-07297 5C

Macrobenthos of the Tidal Delaware River Between Trenton and Burlington, New Jersey, W78-07300 5C

Pollution in the Northeast Pacific Ocean, W78-07325 5B

Technical and Philosophical Aspects of Ocean Disposal, W78-07540 5E

Some Parasites and Diseases of Estuarine Fishes in Polluted Habitats of Mississippi, W78-07546 5C

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter April - June 1977, W78-07558 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter July - September 1977, W78-07560 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter July - September 1977, W78-07561 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume III. Principal Investigators' Reports for the Quarter July - September 1977, W78-07562 6G

### WATER POLLUTION SOURCES

Mercury Pollution of Water (In Bulgarian), W78-07268 5B

Pollution in the Northeast Pacific Ocean, W78-07325 5B

Missouri River Basin Sterol Assay Project Report. Coprostanol, A Positive Marker of Domestic and Run-Off Pollution: Sterol Assay of Wastewater Plant Effluents and Surface Waters of the Lower Main Stem Missouri, W78-07328 5A

Mississippi River Basin Sterol Assay Project Report. Coprostanol, A Positive Molecular Marker of Domestic and Run-Off Sewage, Wastewater Plant Effluent and Surface Waters in the Burlington, Iowa Area on the Mississippi River, W78-07329 5A

Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut, W78-07334 5A

The Use of Galerkin Finite-Element Methods to Solve Mass-Transport Equations, W78-07354 5B

Dallas Urban Runoff, Storm of February 11, 1977, W78-07361 2B

Nonpoint Nitrate Contamination of Ground Water in Merrick County, Nebraska, W78-07506 5B

Sub-Seabed Disposal of Radioactive Waste: Prevention or Management, W78-07536 5E

Environmental Management of a Ship Channel-Harbor Complex, W78-07539 5B

Technical and Philosophical Aspects of Ocean Disposal, W78-07540 5E

Industrial Wastes, MESA New York Bight Atlas Monograph 30, W78-07547 5B

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter April - June 1977, W78-07559 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter July - September 1977, W78-07560 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter July - September 1977, W78-07561 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume III. Principal Investigators' Reports for the Quarter July - September 1977, W78-07562 6G

### WATER POLLUTION TREATMENT

Concentrators for Recovering Liquid Pollutant Floating on the Surface of a Sheet of Water, W78-07233 5G

Removal of Color from Paper Mill Waste Waters, W78-07238 5D

Oil Salvage Ship with Ocean Going Bow, W78-07239 5G

Method for Clarifying Waste Water Containing Finely Divided Oily Materials, W78-07245 5D

Process for Clarification of Oil-Containing Waste, W78-07248 5D

Process for Treating Wool Scouring Wastes, W78-07249 5D

Sewage Purification System, W78-07250 5D

Water Purifying Device Without Movable Mechanical Part in Contact with the Liquid to be Treated, W78-07252 5D

Pretreatment Filter Press Dewatering System, W78-07254 5D

### WATER PURIFICATION

Apparatus for Purifying Water, W78-07251 5F

### WATER QUALITY

The Relationship of Lake Quality to Specific Urbanization Stresses, W78-07204 5C

Water Resources Data for Minnesota, Water Year 1976, W78-07313 7C

Water Resources Data for Arkansas, Water Year 1976, W78-07314 7C

Water Resources of the Weiser River Basin, West-Central Idaho, W78-07342 4A

Availability and Quality of Ground Water in the Drain-Yoncalla Area, Douglas County, Oregon, W78-07347 7C

Unsteady-State Water-Quality Model, W78-07348 5B

Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico, W78-07352 8B

Economic Impact of Water Quality on River Basin Management, W78-07396 5G

## WATER QUALITY

- Salt Loading in Disturbed Watershed-Field Study, W78-07484 5B
- Sub-Seabed Disposal of Radioactive Waste: Prevention or Management, W78-07536 5E
- Water Quality. MESA New York Bight Atlas Monograph 27, W78-07542 5B
- Evaluation of Water Quality of Puget Sound and Hood Canal in 1976, W78-07544 5C
- Use of Benthic Sediments as Indicators of Marina Flushing, W78-07553 5A
- Quality of Irrigation Return Flow from Flooded Rice Paddies, W78-07623 5B
- Investigation of Remote Water-Quality Monitoring Systems for Use With GOES or ERTS Water Data Transmitter, W78-07678 5A
- WATER QUALITY CONTROL**
- Water Quality Model for the Upper North Platte River, W78-07206 5B
- Removal of Color from Paper Mill Waste Waters, W78-07238 5D
- Device for Collecting Light-Weight Substances Floating on a Liquid Surface, W78-07253 5G
- Benthic Semi-Barrier to Control the Growth of Weeds in Aquatic Environments, W78-07257 5G
- Nuisance-Algae Control Through Mechanical Harvesting, W78-07266 5G
- Restoration of Lower St. Regis Lake (Franklin County, New York), W78-07291 5G
- Proceedings of National Conference: Irrigation Return Flow Quality Management, W78-07606 5G
- The Role of EPA's Office of Research and Development in Irrigated Crop Production Research, W78-07607 5G
- How the NPDES Program Will Define Present Water Quality Conditions, W78-07637 5G
- The 1973 Agreement on Colorado River Salinity Between the United States and Mexico, W78-07643 6E
- The EPA General Permit Program, W78-07651 5G
- Interface of Water Quantity and Quality Laws in the West, W78-07652 6E
- An Influent Control Approach to Irrigation Return Flow Quality Management, W78-07653 5G

## SUBJECT INDEX

- A Process for Identifying, Evaluating and Implementing Solutions for Irrigation Return Flow Problems, W78-07654 5G
- WATER QUALITY STANDARDS**
- Viruses in Water: The Increasing Urgency of the Problem and Approaches to its Solution (In Russian), W78-07261 5G
- Pollution Control in the Baltic is Result of Cooperation, W78-07528 5G
- WATER REQUIREMENTS**
- Energy and Water, W78-07508 6D
- WATER RESOURCES**
- Freshwater Resources of the Oregon Coastal Zones, W78-07281 2L
- Water Resources of the Weiser River Basin, West-Central Idaho, W78-07342 4A
- Seepage Study of the Sevier Valley-Piute Canal, Sevier County, Utah, W78-07360 4A
- Water Resources and Climatic Change, W78-07380 2A
- Modernization and Improvement of New York's Riparian Law, W78-07410 6E
- U.S. IFYGL Ship System: Description of Archived Data, W78-07554 2H
- WATER REUSE**
- Make Wastewater More Versatile: Reuse it for Recreation Lakes, W78-07217 5D
- Reuse of Municipal Wastewater for Groundwater Recharge, W78-07570 5D
- WATER RIGHTS**
- Case Note: Water and Water Courses -- Limiting the Reservation Doctrine. Mimbres Valley Irrigation Co. v. Salopek, 564 P.2d 615(N.M.1977), cert.granted, 46U.S.L.W. 3426(No.77-510), W78-07211 6E
- Administrative Practice and Procedure Under Permit Systems, W78-07411 6E
- General Adjudication Proceedings, W78-07412 6E
- Practical Aspects of Water Litigation, W78-07413 6E
- Interface of Water Quantity and Quality Laws in the West, W78-07652 6E
- WATER SAMPLING**
- Water Well Samples Must be Collected with Care, W78-07584 5A
- WATER SOFTENING**
- Treatment of Water to Remove Certain Ions Therefrom, W78-07246 5F

- WATER STORAGE**
- Cottage Farm Combined Sewer Detection and Chlorination Station, Cambridge, Massachusetts, W78-07534 5D
- WATER SUPPLY DEVELOPMENT**
- Future Treatment Plant Requirements, W78-07474 5D
- WATER TABLE**
- Western Kansas Faces Declining Water Table, W78-07583 4B
- WATER TEMPERATURE**
- Annual Fluctuations in Biomass of Taxonomic Groups of Zooplankton in the California Current, W78-07275 5C
- Improved Under-Water Sampler for Limnological Work, W78-07276 7B
- Antecedent Event Influence on Benthic Marine Algal Standing Crops in Hawaii, W78-07295 2L
- The Dishonest Method in Stream Temperature Modeling, W78-07392 2D
- WATER TREATMENT**
- Treatment of Water to Remove Certain Ions Therefrom, W78-07246 5F
- Apparatus for Purifying Water, W78-07251 5F
- Particle Disruption in Flocculating Systems, W78-07321 5F
- Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater, W78-07463 5F
- European Water Treatment Practices and What We Can Learn from Them, W78-07604 5F
- WATER UTILIZATION**
- Future Treatment Plant Requirements, W78-07474 5D
- WATER WELLS**
- Relationship Between Groundwater Resources and Energy Production in Southwestern Missouri, W78-07202 2K
- Availability and Quality of Ground Water in the Drain-Yoncalla Area, Douglas County, Oregon, W78-07347 7C
- Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico, W78-07352 8B
- Water-Level Changes in Wells Along the West Side of the Cedar Creek Anticline, Southeastern Montana, W78-07357 4B
- Description of Wells at Beale Air Force Base and Vicinity, California, W78-07358 4B
- Flow to a Nonpenetrating Well in a Leaky Artesian Aquifer with Variable Discharge, W78-07378 2F



# SUBJECT INDEX

## ZEOLITES

- State Agencies and Officials Responsible for Water Well Industry Codes and Licensing. W78-07573 6F
- Water Well Industry Codes and Licensing. W78-07574 6F
- How to Meet Well Project Goals: Part 1. W78-07581 4B
- NWAA's Most Requested Statistics. W78-07582 8A
- Water Well Samples Must be Collected with Care. W78-07584 5A
- Packers and Seals Serve Many Uses. W78-07585 8C
- WATER YIELD**
- Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico. W78-07352 8B
- WATERSHED (BASINS)**
- S-Hydrographs and Change of Unit Hydrograph Duration. W78-07385 2A
- Methods for Calculating Maximum Flood Discharges for Natural Watercourses and Urban Areas in the U.S.S.R.. W78-07697 2A
- WATERWAYS (TRANSPORTATION)**
- Environmental Management of a Ship Channel-Harbor Complex. W78-07539 5B
- WAVE ENERGY**
- Linear and Nonlinear Wave Action Estimates. W78-07485 2L
- WAVES (WATER)**
- Shoreline Plant Establishment and Use of a Wave-Stilling Device. W78-07230 2L
- Linear and Nonlinear Wave Action Estimates. W78-07485 2L
- WEATHER FORECASTING**
- Analysis of Intense Precipitation in the Krasnoyarsk Area. W78-07374 2B
- WEIRS**
- Design of Constant Accuracy Linear Proportional Weir. W78-07492 8B
- Unified Presentation of Weir-Aeration Data. W78-07494 2E
- WEISER RIVER BASIN (IDA)**
- Water Resources of the Weiser River Basin, West-Central Idaho. W78-07342 4A
- WELL CASINGS**
- Packers and Seals Serve Many Uses. W78-07585 8C
- WELL FIELD MANAGEMENT**
- Well Field Management. W78-07577 4B
- WELL SCREENS**
- Packers and Seals Serve Many Uses. W78-07585 8C
- WELLTON-MOHAWK PROJECT (ARIZ)**
- An Assessment of Irrigation Efficiencies and Drainage Return Flows from the Wellton-Mohawk Division of the Gila Project. W78-07644 3C
- Wellton-Mohawk On-Farm Systems Improvement Program. W78-07645 3C
- WEST POINT LAKE (GA)**
- West Point Lake Postimpoundment Study. W78-07287 5C
- WESTERN U.S.**
- Practical Aspects of Water Litigation. W78-07413 6E
- WETLANDS**
- Planning Guidelines for Residential and Path Development in Michigan's Sand Dunes and Wetlands. W78-07227 4A
- Delineation of Tidal Wetlands Boundaries in Lower Chesapeake Bay and its Tributaries. W78-07229 2L
- Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland. W78-07279 5C
- York County and Town of Poquoson Tidal Marsh Inventory. W78-07310 2L
- Hydraulics of Sheet Flow in Wetlands. W78-07340 8B
- Impact of a Power Plant on the Ground-Water System of a Wetland. W78-07377 6G
- WETTING**
- Effects of Wetting Agents on Water Infiltration into Water-Repellent Coal Mine Spoils. W78-07370 5G
- WHITE AMUR**
- Production of Monosex White Amur for Aquatic Plant Control. W78-07326 4A
- WHITE SANDS MISSILE RANGE (N MEX)**
- Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico. W78-07352 8B
- WILD BROOK TROUT**
- Factors Involved in the Resistance of Brook Trout to Sulfuric Acid Solutions and Mine Acid Polluted Waters. W78-07684 5C
- WILD RIVERS**
- An Attempt to Quantify the Esthetics of Wild and Scenic Rivers in Idaho. W78-07220 6B
- WILDLIFE**
- Effects of Stream Channelization on Terrestrial Wildlife and Their Habitats in the Buena Vista Marsh, Wisconsin. W78-07228 6G
- WILDLIFE HABITATS**
- Productivity of Red-Winged Blackbirds in Prairie Pothole Habitat. W78-07339 2I
- WIND EFFECTS**
- Surface-Drifter Movements Observed in Outer Strait of Juan de Fuca, July 1977. W78-07545 5B
- WIND POWER**
- Identification of Alternative Power Sources for Dredged Material Processing Operations. W78-07680 8C
- WIND-POWERED COMPRESSORS**
- Wind Powered Artificial Aeration of Northern Prairie Lakes. W78-07201 8C
- WIND-TUNNEL TESTS**
- Investigation of Snow Control Systems on an Avalanche Slope. W78-07375 4A
- WISCONSIN**
- Effects of Stream Channelization on Terrestrial Wildlife and Their Habitats in the Buena Vista Marsh, Wisconsin. W78-07228 6G
- Land Use and Pollution Patterns on the Great Lakes. W78-07288 5B
- Impact of a Power Plant on the Ground-Water System of a Wetland. W78-07377 6G
- WISCONSIN RIVER**
- Impact of a Power Plant on the Ground-Water System of a Wetland. W78-07377 6G
- WYOMING**
- Water Quality Model for the Upper North Platte River. W78-07206 5B
- Rainfall and Runoff Data from Small Basins in Wyoming. W78-07349 7C
- Preliminary Digital Model of the Arikaree Aquifer in the Sweetwater River Basin, Central Wyoming. W78-07351 2F
- YAKIMA VALLEY (CALIF)**
- Irrigation Return Flow Problems in Yakima Valley. W78-07640 5G
- YAMPA RIVER BASIN (COLO WYO)**
- Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Rout County, Colorado. W78-07356 5B
- YEASTS**
- Microbial Interactions with Pesticides in Estuarine Surface Slicks. W78-07605 5C
- YONCALLA AREA (OREG)**
- Availability and Quality of Ground Water in the Drain-Yoncalla Area, Douglas County, Oregon. W78-07347 7C
- YOUNGSTOWN (OHIO)**
- Dye Infusion Technique Assesses Stream Pollution in Ohio. W78-07373 5B
- ZEOLITES**
- Clinoptilolite Column Ammonia Removal Model. W78-07466 5D

# ZEOBITES

# SUBJECT INDEX

## ZINC

Trace Metal-Chelator Interactions and  
Phytoplankton Growth in Seawater Media:  
Theoretical Analysis and Comparison with Re-  
ported Observations,  
W78-07663 5C

A Preliminary Study of the Use of Benthic  
Algae as Biological Indicators of Heavy Metal  
Pollution in Solfjorden, Norway,  
W78-07665 5A

## ZOOPLANKTON

Annual Fluctuations in Biomass of Taxonomic  
Groups of Zooplankton in the California Cur-  
rent,  
W78-07275 5C

Role of Plankton in the Behavior of TC99 and  
MN54 in Seawater,  
W78-07286 5C

COPEPOD4: A Discrete Time-Delay Model of  
Copepod Population Dynamics,  
W78-07289 5B

Use of Zooplanktophagic Fishes in Channel  
Catfish Production Ponds,  
W78-07292 5C

ABBOTT, A.  
Problems in  
Some Small  
W78-07427

ABBOTT, B.  
Marine Pol-  
W78-07297

ADAMEK, R.  
Preliminary  
Waters from  
of Intestine  
W78-07223

AGEMIAN, J.  
A Study  
Methods  
Aquatic Sci-  
W78-07278

AHEARN, D.  
Microbial  
Estuarine  
W78-07600

AHLERT, R.  
Nitrification  
W78-07211

AITKEN, A.  
Urban Hy-  
Research  
W78-07699

ALEXANDER,  
Land Use  
the Central  
W78-07311

ALLEN, J. L.  
Water-Com-  
Plant Asses-  
Chemical  
Estuary Pro-  
W78-07200

ALLEN, S.  
Restoration  
County, Tex-  
W78-07299

ALVAREZ,  
Economic  
Basin Man-  
W78-07399

ANDERSON,  
Industrial  
Atlas Mo-  
W78-07549

ANDERSON,  
Copper Sulf-  
W78-07600

ANDERSON,  
The Nation-  
U.S. Geo-  
W78-07311

ANDERSON,  
The EPA  
W78-07600

ANDERSON,  
Impact of  
System on  
W78-07311

# AUTHOR INDEX

- ABBOTT, A. L.**  
Problems Encountered in the Up-Grading of Some Small Sewage Works, W78-07427 5D
- ABBOTT, B. C.**  
Marine Pollution Hazards, W78-07297 5C
- ADAMEK, R.**  
Preliminary Tests of the Influence of Waste Waters from Sugar Factories on the Numbers of Intestinal Bacteria in Water (In German), W78-07223 5C
- AGEMIAN, H.**  
A Study of Different Analytical Extraction Methods for Nondetrimental Heavy Metals in Aquatic Sediments, W78-07278 5A
- AHEARN, D. G.**  
Microbial Interactions with Pesticides in Estuarine Surface Slicks, W78-07605 5C
- AHLERT, R. C.**  
Nitrification and Nitrogen Removal, W78-07215 5D
- AITKEN, A. P.**  
Urban Hydrological Modeling and Catchment Research in Australia, W78-07699 2A
- ALEXANDER, R. H.**  
Land Use and Environmental Assessment in the Central Atlantic Region, W78-07317 4A
- ALLEN, J. E.**  
Water-Column and Benthic Invertebrate and Plant Associations as Affected by the Physico-Chemical Aspects in a Mesotrophic Bayou Estuary Pensacola, Florida, W78-07203 5C
- ALLEN, S. P.**  
Restoration of Lower St. Regis Lake (Franklin County, New York), W78-07291 5G
- ALVAREZ, D.**  
Economic Impact of Water Quality on River Basin Management, W78-07396 5G
- ANDERSON, A. R.**  
Industrial Wastes, MESA New York Bight Atlas Monograph 30, W78-07547 5B
- ANDERSON, D. M.**  
Copper Sensitivity of *Gonyaulax Tamarensis*, W78-07664 5C
- ANDERSON, J. R.**  
The National Land Use Data Program of the U.S. Geological Survey, W78-07316 4A
- ANDERSON, K.**  
The EPA General Permit Program, W78-07651 5G
- ANDERSON, M. P.**  
Impact of a Power Plant on the Ground-Water System of a Wetland, W78-07377 6G
- ANDERSON, R. D.**  
Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado, W78-07356 5B
- ANDO, A.**  
A Pilot Plant Study on Advanced Treatment of Treated Sewage for Re-Use, (In Japanese), W78-07445 5D
- ANDREWS, C. B.**  
Impact of a Power Plant on the Ground-Water System of a Wetland, W78-07377 6G
- APOSTOLOVA, R. D.**  
The Effect of the Ionic Composition of the Environment on Oxygen Exchange in the Alga *Acetabularia* (In Russian), W78-07213 5C
- APPLETON, B.**  
Hoscar's Extension Should Deodorize the Douglas, W78-07418 5D
- ARATANI, T.**  
Kinetic Studies on the Lime Sulfurated Solution (Calcium Polysulfide) Process for Removal of Heavy Metals from Waste Water, W78-07595 5D
- ARCHIBOLD, O. W.**  
Variation of Drainage Density in a Small British Columbia Watershed, W78-07505 4D
- ARMSTRONG, B. L.**  
Derivation of Initial Soil Moisture Accounting Parameters from Soil Properties for the National Weather Service River Forecast System, W78-07551 2G
- ARYAMOYA, AH. M.**  
Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C
- ATKINSON, L. P.**  
The Results of Four Oceanographic Cruises in the Georgia Bight, W78-07537 2L
- AUMEN, W. G.**  
Water-Column and Benthic Invertebrate and Plant Associations as Affected by the Physico-Chemical Aspects in a Mesotrophic Bayou Estuary Pensacola, Florida, W78-07203 5C
- AUSTIN, T. A.**  
Problem Identification and Ranking, An Assessment of a River Basin Planning Process, W78-07687 6B
- AVERY, M. J.**  
Analysis of Various Iowa Waters for Selected Pesticides: Atrazine, DDE, and Dieldrin--1974, W78-07331 5A
- AYARS, J. E.**  
Modeling Salt Transport in the Irrigated Soils of Grand Valley, W78-07648 5B
- AYERS, S. D.**  
Water-Level Changes in Wells Along the West Side of the Cedar Creek Anticline, Southeastern Montana, W78-07357 4B
- BACA, R. G.**  
A Generalized Water Quality Model for Eutrophic Lakes and Reservoirs, W78-07290 5C
- BAGDASARYAN, G. A.**  
The Effect of Chemicals on Some Microbial Self-Purification Processes in Bodies of Water (In Russian), W78-07298 5C
- BAGGALEY, A.**  
Physical-Chemical Methods for the Control of Algal Species and Composition in Algal Culturing Facilities, W78-07324 5G
- BAGHERZADEH, P.**  
Adsorption of Textile Dyes by Activated Carbon Produced from Agricultural, Municipal and Industrial Wastes, W78-07599 5D
- BAGNYUK, V. M.**  
Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C
- BAHR, A.**  
Pretreatment Filter Press Dewatering System, W78-07254 5D
- BAILEY, G. W.**  
Protonation of Organic Bases in Clay-Water Systems, W78-07364 5B
- BAKER, J. M.**  
Lawton Advanced Wastewater Treatment Plant, W78-07452 5D
- BALLUZ, S. A.**  
The Behavior of F2 Coliphage in Activated Sludge Treatment, W78-07461 5D
- BALOG, J. D.**  
Flooding in Big Thompson River, Colorado, Tributaries: Controls on Channel Erosion and Estimates of Recurrence Interval, W78-07371 4D
- BANKS, G. J.**  
Starch-Laden Effluent Treatment-A Case History, W78-07591 5D
- BARJA, J.**  
Method of Average Birth and Death Rate Evaluation in the Marine-Terrestrial Bacteria Interactions, W78-07263 5C
- BARJA, J. L.**  
Method of Average Birth and Death Rate Evaluation in the Marine-Terrestrial Bacteria Interactions, W78-07263 5C
- BARKER, D. S.**  
Rainfall and Runoff Data from Small Basins in Wyoming, W78-07349 7C
- BARNWELL, T. O. JR.**  
West Point Lake Postimpoundment Study, W78-07287 5C



# AUTHOR INDEX

BARRETT, J. W. H.

BARRETT, J. W. H.

A Process for Identifying, Evaluating and Implementing Solutions for Irrigation Return Flow Problems.  
W78-07654 5G

BARRY, J. R.

Greenhouse Studies of the Growth and Reproduction of *Egeria Densa*.  
W78-07401 4A

BARTIK, I.

Element for Filtering and Separating Fluid Mixtures.  
W78-07240 5D

BARTOS, M. J. JR.

Containment Area Management to Promote Natural Dewatering of Fine-Grained Dredged Material.  
W78-07673 5E

BASKETT, R. C.

Make Wastewater More Versatile: Reuse it for Recreation Lakes.  
W78-07217 5D

BATU, V.

Steady-State Solute Convection in Two Dimensions with Nonuniform Infiltration.  
W78-07381 2G

BATURIN, G. N.

Composition of Suspensions and Sediments in the Estuaries of the Northern Dvina, Mezen', Pechora, and Ob' Rivers.  
W78-07405 2L

BAUER, D. P.

Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado.  
W78-07356 5B

Unsteady-State Water-Quality Model.  
W78-07348 5B

BAUSCH, W.

Effect of Irrigation Systems on Water Use Efficiency and Soil Water Solute Concentrations.  
W78-07620 5G

Effect of Three Irrigation Systems on Distribution of Fertilizer Nitrate Nitrogen in Soil.  
W78-07610 5B

BEARDALL, J.

Photorespiration in Marine Phytoplankton.  
W78-07309 5C

BECK, L. A.

A Valleywide Solution--The Interagency Drainage Program.  
W78-07639 4A

BENISEK, L.

Chrome Dyeing of Wool: Reducing the Amount of Chromium in the Residual Bath.  
W78-07601 5D

BENNETT, E. R.

New Procedure Determines Aerobic Sludge Stability.  
W78-07464 5D

BENNETT, J. P.

Unsteady-State Water-Quality Model.  
W78-07348 5B

BENSON, H. A.

Dispersion of Proposed Effluent Discharges and Saltwater Intrusion in Cooper River: Hydraulic Model Investigation.  
W78-07670 5B

BERNARDEZ, I.

IBM 1130 Computation Process in the Study of Biophysical Constants Variations of Pathogenic Bacteria by Phytoplankton.  
W78-07264 5C

BERNOVSKAYA, R. N.

Role of Plankton in the Behavior of TC99 and MN54 in Seawater.  
W78-07286 5C

BIALAS, W. F.

Nonstructural Floodplain Planning.  
W78-07221 6F

BIGGAR, J. W.

Evaluation of Surface Irrigation Return Flows in the Central Valley of California.  
W78-07624 5B

Theoretical and Experimental Observations of Water and Nitrate Movement Below a Crop Root Zone.  
W78-07615 5B

BLACKBURN, R. D.

Aquatic Use Pattern for Diquat for Control of *Egeria* and *Hydrilla*.  
W78-07399 5G

Efficacy and Residues of Diquat Applied for Control of *Egeria* and *Hydrilla*.  
W78-07400 5G

BLAIR, L. F.

Problem Identification and Ranking, An Assessment of a River Basin Planning Process.  
W78-07687 6B

BLASZCZYK, P.

Urban Runoff Research in Poland.  
W78-07691 2A

BLOUNT, E. A.

Plater Meets 'New Source' Requirements.  
W78-07593 5D

BLUM, S. R.

COPEPOD4: A Discrete Time-Delay Model of Copepod Population Dynamics.  
W78-07289 5B

BOCK, D. H.

Suggested Method for Vanadate Removal from Mill Effluents.  
W78-07332 5D

BOEHNEKE, H.

Sedimentary Record of Heavy Metals and Polycyclic Aromatic Hydrocarbons in Lake Constance (In German).  
W78-07307 5B

BOES, D. C.

Nonstationarity of the Mean and the Hurst Phenomenon.  
W78-07388 2E

BOLAND, R. A.

Dispersion of Proposed Effluent Discharges and Saltwater Intrusion in Cooper River: Hydraulic Model Investigation.  
W78-07670 5B

BOND, S.

Summary Report - The Chowan River Project.  
W78-07318 5C

BONDURANT, J. A.

Management Guidelines for Controlling Sediments, Nutrients, and Adsorbed Biocides in Irrigation Return Flows.  
W78-07622 5G

BONGIORNO, S.

Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut.  
W78-07334 5A

BOON, J. D. III

Delineation of Tidal Wetlands Boundaries in Lower Chesapeake Bay and its Tributaries.  
W78-07229 2L

BOOTH, A. C.

Clinoptilolite Column Ammonia Removal Model.  
W78-07466 5D

BORCHERT, W. B.

Preliminary Digital Model of the Arikaree Aquifer in the Sweetwater River Basin, Central Wyoming.  
W78-07351 2F

BORRELLI, J.

Economic and Agronomic Effects of High Irrigation Levels on Alfalfa and Barley.  
W78-07397 3F

BOUGH, W. A.

Effect of Time of Deacetylation on Molecular Weight Distribution, Acetyl Content, Viscosity, and Performance of Chitsan as a Conditioning Agent for Activated Sludge.  
W78-07552 5D

BOULE, M. E.

Delineation of Tidal Wetlands Boundaries in Lower Chesapeake Bay and its Tributaries.  
W78-07229 2L

BOWMAN, M. J.

Nutrient Distributions and Transport in Long Island Sound.  
W78-07550 5B

BRADLEY, B. P.

Adaptation of Copepod Populations to Thermal Stress, II.  
W78-07398 5C

BREKELMANS, K.

Treatment and Use of Sewage Purification Plant Sludges.  
W78-07425 5D

BRINKOFF, H. C.

Instrumentation and Automation in Water and Wastewater Treatment.  
W78-07525 5A

BROADBENT, F. E.

Soil Nitrate Concentrations in Corn Plots Treated with Isotopically Labeled Nitrogen Fertilizer.  
W78-07614 5B

BROCKWAY, C. E.

On-Farm Method for Controlling Sediment and Nutrient Losses.  
W78-07626 5G

BROWN, J. A.

The Development of a Hydroperm (TM) Microfiltration System for the Treatment of Domestic Wastewater Effluents.  
W78-07526 5D

BROWN, J. C.

Alum Treatment of Effluent at C  
W78-07409

BROWN, K. W.

Quality of Irrigation  
Rice Paddies  
W78-07623

BRUCH, J. C.

A Variation of  
Free Surface  
W78-07390

BRUNE, R. J.

West Point  
W78-07287

BULKLEY, J.

Innovative  
Planning.  
W78-07222

BULOT, M.

Monitoring  
W78-07470

BUNCH, R. L.

Concepts,  
Biodegradation  
W78-07532

MISSISSIPPI

Report. C  
Marker of  
Wastewater  
in the Bur  
River,  
W78-07329

MISSOURI

port. C  
Domestic  
of Wastew  
Waters of  
W78-07328

BUSBY, M.

Flood-Haz  
Lucerne  
California.  
W78-07359

BUSCH, J. R.

On-Farm  
Nutrient U  
W78-07620

BUTLER, M.

The Beha  
Sludge Tr  
W78-0746

CAMPBELL

Visual O  
Skylab,  
W78-0734

CANNON, J.

Water/W  
W78-0752

CARDWELL

Evaluation  
and Hoo  
W78-0754

CARLILE, J.

Nitrogen  
Return-F  
the Colu  
W78-0761

# AUTHOR INDEX

CLYDE, E. W.

- BROWN, J. C.**  
Alum Treatment of High-Rate Trickling Filter Effluent at Chapel Hill, North Carolina, W78-07409 5D
- BROWN, K. W.**  
Quality of Irrigation Return Flow from Flooded Rice Paddies, W78-07623 5B
- BRUCH, J. C. JR.**  
A Variational Inequality Method Applied to Free Surface Seepage from a Triangular Ditch, W78-07390 4A
- BRUNE, R. J. III**  
West Point Lake Postimpoundment Study, W78-07287 5C
- BULKLEY, J. W.**  
Innovative Management Concept for Planning, W78-07222 5G
- BULOT, M.**  
Monitoring in the Zone of Aeration, W78-07470 5A
- BUNCH, R. L.**  
Concepts, Criteria, and Measurements of Biodegradability, W78-07532 5D  
Mississippi River Basin Sterol Assay Project Report. Coprostanol, A Positive Molecular Marker of Domestic and Run-Off Sewage, Wastewater Plant Effluent and Surface Waters in the Burlington, Iowa Area on the Mississippi River, W78-07329 5A  
Missouri River Basin Sterol Assay Project Report. Coprostanol, A Positive Marker of Domestic and Run-Off Pollution: Sterol Assay of Wastewater Plant Effluents and Surface Waters of the Lower Main Stem Missouri, W78-07328 5A
- BUSBY, M. W.**  
Flood-Hazard Study--100-Year Flood Stage for Lucerne Lake, San Bernardino County, California, W78-07359 4A
- BUSCH, J. R.**  
On-Farm Method for Controlling Sediment and Nutrient Losses, W78-07626 5G
- BUTLER, M.**  
The Behavior of F2 Coliphage in Activated Sludge Treatment, W78-07461 5D
- CAMPBELL, W. J.**  
Visual Observations of Floating Ice from Skylab, W78-07346 2C
- CANNON, J. R.**  
Water/Wastewater Survey Guidelines, W78-07522 5A
- CARDWELL, R. D.**  
Evaluation of Water Quality of Puget Sound and Hood Canal in 1976, W78-07544 5C
- CARLILE, B. L.**  
Nitrogen and Water Management to Minimize Return-Flow Pollution from Potato Fields of the Columbia Basin, W78-07611 5G
- CARLTON, A. B.**  
Soil Nitrate Concentrations in Corn Plots Treated with Isotopically Labeled Nitrogen Fertilizer, W78-07614 5B
- CARPENTER, A. B.**  
Relationship Between Groundwater Resources and Energy Production in Southwestern Missouri, W78-07202 2K
- CARR, M. I.**  
Evaluation of Water Quality of Puget Sound and Hood Canal in 1976, W78-07544 5C
- CARTE, A. E.**  
Variability of Hailstorms on the South African Plateau, W78-07507 2B
- CARTER, D. L.**  
Management Guidelines for Controlling Sediments, Nutrients, and Adsorbed Biocides in Irrigation Return Flows, W78-07622 5G
- CARTER, M. J.**  
Preservation of Phenolic Compounds in Wastewaters, W78-07586 5D
- CASNOFF, D. M.**  
Soil Strength and Soil Temperature: Their Effects on Root Growth of Tall Fescue, W78-07688 2G
- CATALDO, J. C.**  
Prediction of Temperature Due to Heated Discharges, W78-07495 5B
- CHADWICK, D.**  
The Design and Construction of the Martholme Regional Sewage-Treatment Works, W78-07477 5D
- CHAMIE, J. P. M.**  
Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland, W78-07279 5C
- CHANDRA, S.**  
A Simple Laboratory Apparatus to Measure Relative Erodibility of Soils, W78-07504 2J
- CHATAIGNER, J.**  
Water Purifying Device Without Movable Mechanical Part in Contact with the Liquid to be Treated, W78-07252 5D
- CHAU, A. S. Y.**  
A Study of Different Analytical Extraction Methods for Nondetril Heavy Metals in Aquatic Sediments, W78-07278 5A
- CHAUHAN, H. S.**  
Flow to a Nonpenetrating Well in a Leaky Artesian Aquifer with Variable Discharge, W78-07378 2F
- CHEN, C.-L.**  
Independent Physical-Chemical Treatment of Raw Sewage, W78-07516 5D
- CHEN, R.**  
Flood Damages on the Iowa River, W78-07258 4A
- CHERNOGAYEVA, G. M.**  
Transformation of the Hydrologic Budget of the Moscow City Area, W78-07376 4C
- CHITTENDEN, D. M. II.**  
Radionuclide Concentrations in the Arkansas River Upstream and Downstream from the Nuclear I Power Generating Facility, W78-07320 5B
- CHOPRA, R. C.**  
Removal of Chromium, Chromate, Molybdate and Zinc, W78-07231 5D
- CHRISTENSEN, B. A.**  
Hydraulics of Sheet Flow in Wetlands, W78-07340 8B
- CHRISTIANSEN, E. B.**  
The Production of Protein from Municipal Sludge, W78-07447 5D
- CHRISTLE, I. F.**  
Model Tests of Circular Sewage Sedimentation Tanks, W78-07468 5D
- CHUDOVA, I. G.**  
Hygienic Evaluation of Effectiveness of Urban Sewage Purification in Oxidation Ponds (In Russian), W78-07270 5D
- CHUN, M. J.**  
Rotating Disc Sewage Treatment Systems for Suburban Developments and High-Density Resorts of Hawaii, W78-07393 5D
- CIANI, J. B.**  
Identification of Alternative Power Sources for Dredged Material Processing Operations, W78-07680 8C
- CLARK, D. L.**  
An Assessment of Irrigation Efficiencies and Drainage Return Flows from the Wellton-Mohawk Division of the Gila Project, W78-07644 3C
- CLARK, R. T.**  
Economic and Agronomic Effects of High Irrigation Levels on Alfalfa and Barley, W78-07397 3F
- CLARKE, R. T.**  
Some Properties of Variance Reduction Techniques Where Hydrological Extremes Are Estimated by Monte Carlo Simulation, W78-07391 2E
- CLEMENTS, E. V.**  
Reuse of Municipal Wastewater for Groundwater Recharge, W78-07570 5D
- CLYDE, E. W.**  
Administrative Practice and Procedure Under Permit Systems, W78-07411 6E  
General Adjudication Proceedings, W78-07412 6E  
Practical Aspects of Water Litigation, W78-07413 6E

# AUTHOR INDEX

CLYDE, E. W.

- COFFIN, D. L.**  
Water-Level Changes in Wells Along the West Side of the Cedar Creek Anticline, Southeastern Montana, W78-07357 4B
- COLEBROOK, J. M.**  
Annual Fluctuations in Biomass of Taxonomic Groups of Zooplankton in the California Current, W78-07275 5C
- COLER, R. A.**  
A Test of the Effects of Domestic Sewage on the Growth of the Common Blue Mussel, *Mytilus Edulis*, in an Aquacultural System, W78-07205 5C
- COLLINS, C. A.**  
Availability and Quality of Ground Water in the Drain-Yoncalla Area, Douglas County, Oregon, W78-07347 7C
- COLT, J.**  
Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Executive Summary), W78-07563 6G  
Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Final Report), W78-07567 6G
- CONKLIN, L.**  
Economic Analysis of On-Farm Methods for Controlling Sediment and Nutrient Losses, W78-07627 5G
- CONSTANTAKIS, R.**  
Apparatus for Purifying Water, W78-07251 5F
- COOK, G.**  
Summary Report - The Chowan River Project, W78-07318 5C
- COON, D. A.**  
An In Situ Study of Recruitment, Growth and Survival of Subtidal Marine Algae: Techniques and Preliminary Results, W78-07308 5C
- COREY, P. R.**  
Rate of Ammonium Nitrification and Nitrate Leaching in Soil Columns, W78-07520 5B
- COTTRELL, C. T.**  
The Background to, and the Application of, Laboratory Instrumentation to Water Analysis, W78-07458 5A
- COUGHLAN, S.**  
Photorespiration in Larger Littoral Algae, W78-07274 5C
- COWART, J. B.**  
Uranium-Isotope Variations in Groundwaters of the Florida Aquifer and Boulder Zone of South Florida, W78-07343 5B
- COX, J. M.**  
Surface Drifter Movements Observed in Outer Strait of Juan de Fuca, July 1977, W78-07545 5B
- CREEL, B. J.**  
Economics of Controlling Irrigation Return Flow in the Mesilla Valley, New Mexico, W78-07635 5G
- CRISMAN, R. D.**  
Inventory of Lake Ontario Inlets and Harbors: Niagara River to Stony Creek, W78-07225 2H
- CROLEY, T. E.**  
Flood Damages on the Iowa River, W78-07258 4A
- CROSS, J. N.**  
Nearshore Fish and Macroinvertebrate Assemblages Along the Strait of Juan de Fuca Including Food Habits of Nearshore Fish, W78-07543 2L
- CROW, S. A.**  
Microbial Interactions with Pesticides in Estuarine Surface Slicks, W78-07605 5C
- CROW, W. L.**  
Microbial Interactions with Pesticides in Estuarine Surface Slicks, W78-07605 5C
- CRUFF, R. W.**  
Seepage Study of the Sevier Valley-Piute Canal, Sevier County, Utah, W78-07360 4A
- CRUMB, S. E.**  
Macrobenthos of the Tidal Delaware River Between Trenton and Burlington, New Jersey, W78-07300 5C
- CRUMPTON, W. G.**  
Water-Column and Benthic Invertebrate and Plant Associations as Affected by the Physico-Chemical Aspects in a Mesotrophic Bayou Estuary Pensacola, Florida, W78-07203 5C
- CUNNINGHAM, P. A.**  
A Comparative Study of the Effects of Mercuric Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, *Artemia Salina*, W78-07668 5C
- CURTIS, G. W.**  
Frequency Analysis of Illinois Floods Using Observed and Synthetic Streamflow Records, W78-07355 4A  
Technique for Estimating Magnitude and Frequency of Floods in Illinois, W78-07350 4A
- CURTISS, B. H.**  
Nonpoint Nitrate Contamination of Ground Water in Merrick County, Nebraska, W78-07506 5B
- DAGON, T. J.**  
Photographic Processing Effluent Control, W78-07588 5D
- DAIBER, F. C.**  
Tidal Marsh Bibliography, Selected Key Work Index (Partially Annotated), W78-07226 2L
- DARR, J. M.**  
Relationship Between Groundwater Resources and Energy Production in Southwestern Missouri, W78-07202 2K
- DAUBNER, I.**  
Preliminary Tests of the Influence of Waste Waters from Sugar Factories on the Numbers of Intestinal Bacteria in Water (In German), W78-07223 5C
- DAUGUE, R. R.**  
Dye Waste Treatment and Reuse, W78-07600 5D
- DAVIDSON, J. M.**  
Simulation of Nitrogen Movement, Transformations, and Plant Uptake in the Root Zone, W78-07608 5B
- DAVIES, S. H. R.**  
A New Dialysis-Ion Exchange Technique for Determining the Forms of Trace Metals in Water, W78-07277 5A
- DAVIS, B.**  
Los Angeles Faces Several Sludge Management Problems, W78-07448 5D
- DAVIS, G. E.**  
Temperature Requirements of Salmonids in Relation to Their Feeding, Bioenergetics, Growth and Behavior, W78-07322 5C
- DE, S. K.**  
A Simple Laboratory Apparatus to Measure Relative Erodibility of Soils, W78-07504 2I
- DECHORETZ, N.**  
Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, W78-07399 5G  
Aquatic Weed Control in Small Reservoirs with Diquat, W78-07402 5G
- DEESE, D. A.**  
Sub-Seabed Disposal of Radioactive Waste: Prevention or Management, W78-07536 5E
- DEL GRANDE, N. K.**  
Appendix E to Correlation of Dual-Channel Airborne IR Data with Soil Moisture Measurements, W78-07383 2G
- DELANEY, R. H.**  
Economic and Agronomic Effects of High Irrigation Levels on Alfalfa and Barley, W78-07397 3F
- DENISOVA, A. I.**  
Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C
- DENNIS, R. E.**  
U.S. IFYGL Ship System: Description of Archived Data, W78-07554 2H
- DEOTTE, R.**  
Environmental Considerations Relating to Operation and Maintenance of the Texas Gulf Intracoastal Waterway, W78-07538 2L
- DESBORDES, M.**  
Urban Hydrological Modeling and Catchment Research in France, W78-07694 2A



# AUTHOR INDEX

FITZPATRICK, K.

- DESCALS, E. C.  
Taxonomic Studies on Aquatic Hyphomycetes,  
I. Lemniera de Wildeman,  
W78-07271 5A
- DESMEDT, F.  
Solute Transport Through Soil with Nonu-  
niform Water Content,  
W78-07496 2G
- DEUEL, L. E.  
Quality of Irrigation Return Flow from Flooded  
Rice Paddies,  
W78-07623 5B
- DEVIAL, R. M.  
Oil Pollution Monitoring and Monitoring Unit,  
W78-07234 5A
- DIDENKI, O. V.  
Hygienic Evaluation of Effectiveness of Urban  
Sewage Purification in Oxidation Ponds (In  
Russian),  
W78-07270 5D
- DIGIANO, F. A.  
Nitrogen Transformations in Land Treatment,  
W78-07216 5B
- DIRECTO, L. S.  
Independent Physical-Chemical Treatment of  
Raw Sewage,  
W78-07516 5D
- DIRKSEN, C.  
Multiple Tensiometer Flushing System,  
W78-07499 2G
- DNEVICH, R. F.  
New System Cuts Phosphorus for Less Cost,  
W78-07301 5D
- DODD, J. D.  
Shoreline Plant Establishment and Use of a  
Wave-Stilling Device,  
W78-07230 2L
- DONAHUE, B. A.  
Water/Wastewater Survey Guidelines,  
W78-07522 5A
- DOSKINA, T. V.  
The Effect of Chemicals on Some Microbial  
Self-Purification Processes in Bodies of Water  
(In Russian),  
W78-07298 5C
- DOTY, M. S.  
Antecedent Event Influence on Benthic Marine  
Algal Standing Crops in Hawaii,  
W78-07295 2L
- Ecological Components Structuring the  
Seaward Edges of Tropical Pacific Reefs: The  
Distribution, Communities and Productivity of  
Porolithon,  
W78-07327 2L
- DOUGLAS, T. B.  
A Test and a Technique for Predicting BOD5  
Values of Kraft Mill Waste,  
W78-07597 5A
- DOWNING, G. C.  
Positioning Techniques and Equipment for U.  
S. Army Corps of Engineers Hydrographic Sur-  
veys,  
W78-07676 7B
- DRINKENBURG, A. A. H.  
The Recovery of Protein From Potato Juice  
Waste Water by Foam Separation,  
W78-07592 5D
- DUCRET, G. L. JR.  
Report of the Annual Yield of the Arkansas  
River Basin for the Arkansas River Basin Com-  
pact, Arkansas--Oklahoma, 1977 Water Year,  
W78-07345 4A
- DUKE, H. R.  
Artificial Ground-Water Recharge with Capil-  
larity,  
W78-07365 4B
- DUNLAP, W. J.  
Nutrient, Bacterial, and Virus Control as Re-  
lated to Ground Water Contamination,  
W78-07571 5B
- DURVE, V. S.  
Improved Under-Water Sampler for Limnologi-  
cal Work,  
W78-07276 7B
- DYKES, L. S.  
A Coring and Squeezing Technique for the  
Detailed Study of Subsurface Water Chemis-  
try,  
W78-07575 2K
- DYKO, B. S.  
Taxonomic Studies on Aquatic Hyphomycetes,  
I. Lemniera de Wildeman,  
W78-07271 5A
- EASTMAN, J. A.  
Solubilization of Organic Carbon During the  
Acid Phase of Anaerobic Digestion,  
W78-07518 5D
- EBBESMEYER, C. C.  
Surface Drifter Movements Observed in Outer  
Strait of Juan de Fuca, July 1977,  
W78-07545 5B
- EBERLE, C. M.  
NWWA's Most Requested Statistics,  
W78-07582 8A
- EL-GASSEIR, M.  
Energy and Water,  
W78-07508 6D
- ELCHAK, T. L.  
An Energy Model of Pennsylvania,  
W78-07685 6A
- ELLIOTT, W. R.  
Maximizing Phosphorus Removal in Activated  
Sludge,  
W78-07446 5D
- ELMARAGHY, G. A.  
Studies on the Toxicity of Ammonia, Nitrate  
and their Mixtures to Guppy Fry,  
W78-07214 5C
- ELPHICK, A.  
Ozone in the Treatment of Odors from Sewage  
Works,  
W78-07434 5D
- ENGEL, D. W.  
Effect of Chemical Speciation on Toxicity of  
Cadmium to Grass Shrimp, Palaemonetes  
Pugio: Importance of Free Cadmium Ion,  
W78-07662 5C
- ERALP, A. E.  
pH Averaging,  
W78-07456 5A
- ERLANDSSON, B.  
Medically Used Radionuclides in Sewage  
Sludge,  
W78-07460 5A
- ERNST, W. R.  
Adsorption of Textile Dyes by Activated Car-  
bon Produced from Agricultural, Municipal and  
Industrial Wastes,  
W78-07599 5D
- ERUSALIMSKAYA, L. F.  
Hygienic Evaluation of Effectiveness of Urban  
Sewage Purification in Oxidation Ponds (In  
Russian),  
W78-07270 5D
- EUGSTER, J.  
Phosphorus Removal by Precipitation with Fe  
(III),  
W78-07465 5D
- EVANS, R. G.  
Development of Best Management Practices  
for Salinity Control in Grand Valley,  
W78-07650 5G
- Evaluating Appropriate Technologies for  
Salinity Control in Grand Valley,  
W78-07649 5G
- The Hydro-Salinity System in the Grand Val-  
ley,  
W78-07647 5G
- EVERITT, I.  
Heat Treatment and Pressing of Digested  
Sludge,  
W78-07437 5D
- EXNER, M. E.  
Nonpoint Nitrate Contamination of Ground  
Water in Merrick County, Nebraska,  
W78-07506 5B
- FAGO, D. M.  
Northern Pike Production in Managed  
Spawning and Rearing Marshes,  
W78-07293 5C
- FARNHAM, W. H.  
Modernization and Improvement of New  
York's Riparian Law,  
W78-07410 6E
- FARRAH, S. R.  
Concentration of Enteroviruses from Large  
Volumes of Tap Water, Treated Sewage, and  
Seawater,  
W78-07463 5F
- FAVELL, G. E.  
Ozone in the Treatment of Odors from Sewage  
Works,  
W78-07434 5D
- FELSTEHAUSEN, H.  
Problem Identification and Ranking. An As-  
sessment of a River Basin Planning Process,  
W78-07687 6B
- FIELDS, D. E.  
Lined: A One Dimensional Multireach Sed-  
iment Transport Model,  
W78-07363 2J
- FISHER, J. G.  
Suggested Method for Vanadate Removal from  
Mill Effluents,  
W78-07332 5D
- FITZPATRICK, K.  
Land Use and Environmental Assessment in  
the Central Atlantic Region,  
W78-07317 4A

# AUTHOR INDEX

FITZSIMMONS, D. W.

FITZSIMMONS, D. W.

On-Farm Method for Controlling Sediment and Nutrient Losses, W78-07626 5G

FLANIGAN, G. A.

Ratioing Methods Applied to Gas Chromatographic Data for Oil Identification, W78-07269 5A

FOERSTER, J. W.

Management of the Northern Chesapeake Bay American Shad Fishery, W78-07337 6B

FOLEY, M. G.

Scour and Fill in Steep, Sand-Bed Ephemeral Streams, W78-07379 2J

FOLEY, S.

Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut, W78-07334 5A

FORD, A. W.

Investigation of Remote Water-Quality Monitoring Systems for Use With GOES or ERTS Water Data Transmitter, W78-07678 5A

FORET, J. A.

Greenhouse Studies of the Growth and Reproduction of Egeria Densa, W78-07401 4A

FOSTER, M. S.

An In Situ Study of Recruitment, Growth and Survival of Subtidal Marine Algae: Techniques and Preliminary Results, W78-07308 5C

FOSTER, W. E.

Conserve Energy in Wastewater Systems, W78-07476 5D

FOURNIER, R. O.

A Simple Model for Cross-Shelf Mixing on the Scotian Shelf, W78-07366 2L

FOWLER, H.

Wastewater Effluent Line Serves Dual Purpose, W78-07419 5E

FOWLER, W. J.

Process for Clarification of Oil-Containing Waste, W78-07248 5D

FOX, C. JR.

Evaluation of the Cost-Effectiveness of Non-structural Pollution Controls: A Manual for Water Quality Management Planning, W78-07336 5G

FRANK, P. A.

Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, W78-07399 5G

Aquatic Weed Control in Small Reservoirs with Diquat, W78-07402 5G

FRAPE, S. K.

A Coring and Squeezing Technique for the Detailed Study of Subsurface Water Chemistry, W78-07575 2K

FREDSOE, J.

Sedimentation of River Navigation Channels, W78-07486 2J

FREELAND, G. L.

The 1973 Bathymetric Survey in the New York Bight Apex: Maps and Geological Implications, W78-07548 2L

FRENCH, V. H.

Buckland Pollution Control Centre Improves Environment in the South West, W78-07443 5D

FRENKEL, H.

Effects of Clay Type and Content, Exchangeable Sodium Percentage, and Electrolyte Concentration on Clay Dispersion and Soil Hydraulic Conductivity, W78-07498 2G

FRESH, K. L.

Nearshore Fish and Macroinvertebrate Assemblages Along the Strait of Juan de Fuca Including Food Habits of Nearshore Fish, W78-07543 2L

FRITZ, J. S.

Analysis of Various Iowa Waters for Selected Pesticides: Atrazine, DDE, and Dieldrin--1974, W78-07331 5A

FUHS, G. W.

Restoration of Lower St. Regis Lake (Franklin County, New York), W78-07291 5G

FUJIOKA, R. S.

Recycling of Water for Irrigation: Persistence of Enteroviruses in Sewage Effluent and Natural Waters Receiving the Effluent, W78-07471 5B

FUKUSHI, K.

Steric Hindrance on Competitive Interaction in Activated Carbon Adsorption from BI-Solute Solution of Phenol and Organics in Biological Treated Sewage, (In Japanese), W78-07455 5D

FULLER, G. A.

Generation of Ungaged Streamflow Data, W78-07384 2A

GAETZ, C. T.

Water-Column and Benthic Invertebrate and Plant Associations as Affected by the Physico-Chemical Aspects in a Mesotrophic Bayou Estuary Pensacola, Florida, W78-07203 5C

GANGSTAD, E. O.

Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, W78-07399 5G

Aquatic Weed Control in Small Reservoirs with Diquat, W78-07402 5G

Efficacy and Residues of Diquat Applied for Control of Egeria and Hydrilla, W78-07400 5G

GARDNER, W. R.

Steady-State Solute Convection in Two Dimensions with Nonuniform Infiltration, W78-07381 2G

GAW, T. I.

Oil Salvage Ship with Ocean Going Bow, W78-07239 5G

GEHRS, C. W.

COPEPOD4: A Discrete Time-Delay Model of Copepod Population Dynamics, W78-07289 5B

GELHAR, L. W.

Economics of Controlling Irrigation Return Flow in the Mesilla Valley, New Mexico, W78-07635 5G

GER, A. M.

Circumferential Diffusion in Pipe Mixing, W78-07488 8B

GERBA, C.

Viruses in Water: The Increasing Urgency of the Problem and Approaches to its Solution (In Russian), W78-07261 5G

GERBA, C. P.

Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater, W78-07463 5F

GIESLER, S.

Environmental Considerations Relating to Operation and Maintenance of the Texas Gulf Intracoastal Waterway, W78-07538 2L

GIGGEY, M. D.

National Needs for Combined Sewer Overflow Control, W78-07422 5D

GLASGOW, L. A.

Particle Disruption in Flocculating Systems, W78-07321 5F

GLAZE, W. H.

Total Organic Halogen as Water Quality Parameter: Adsorption/Microcoulometric Method, W78-07273 5A

GLEATON, J.

The Sulphur Creek Pilot Project: A Practical Approach to Control of Pollutants Leaving Irrigated Farmlands, W78-07641 5G

GOERTZEN, J. O.

Effects of Clay Type and Content, Exchangeable Sodium Percentage, and Electrolyte Concentration on Clay Dispersion and Soil Hydraulic Conductivity, W78-07498 2G

GOLDHAMER, D. A.

Field Measured Flux of Volatile Denitrification Products as Influenced by Soil Water Content and Organic Carbon Source, W78-07613 5G

GONZALES, J. L.

Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico, W78-07352 8B

GOODLING, J. S.

The Effects of Diurnal Mixing on Thermal Stratification of Static Impoundments, W78-07210 2H

GOODMAN, A. S.

Prediction of Temperature Due to Heated Discharges, W78-07495 5B

GOPALAKRISHNAN, V.

Comparison of Models for Copepod Population Dynamics, W78-07472 5B

GORDEYEV, V. V.

Composition of the Estuaries of the Pechora, and the Yenisey, W78-07405 5G

GORDON, J.

Water Hyacinth Filtration of W78-07299 5G

GORMLY, J. F.

Nonpoint Source Pollution in Water in Mexico, W78-07506 5G

GORSKI, W.

Investigation of the Coastal Zone of the Baltic Sea, W78-07265 5F

GOSSETT, J.

Effect of Temperature and Dew Point on the Distribution of W78-07457 2L

GOYAL, S. M.

Concentration of Volumes of Seawater, W78-07463 5D

GREEP, L. A.

Water/Wastewater Treatment, W78-07522 5F

GRIFFITH, C.

Rotating Disk Adsorption/Microcoulometric Method, W78-07393 5A

GRIMMER, R.

Sedimentation of Polycyclic Aromatic Hydrocarbons, W78-07307 5G

GROMIEC, J.

Industrial Wastewater Treatment, W78-07590 5G

GROMOV, V.

Role of Phosphorus in the MN54 in the Baltic Sea, W78-07280 5G

GROSCH, D.

A Comparative Study of Chlorine Residuals, W78-07666 5G

GROSS, T.

Innovative Planning, W78-07222 5G

GROVE, D.

The Use of Remote Sensing to Solve Water Quality Problems, W78-07335 5G

GRUGER, I.

Pollution Control, W78-07332 5B

# AUTHOR INDEX

HAUTALA, E.

- GOPALAKRISHNAN, T. C.**  
Comparison of Numerical Simulation Flow Models for Coastal Inlets, W78-07472 2L
- GORDEYEV, V. V.**  
Composition of Suspensions and Sediments in the Estuaries of the Northern Dvina, Mezen', Pechora, and OB' Rivers, W78-07405 2L
- GORDON, J.**  
Water Hyacinths and Alligator Weeds for Final Filtration of Sewage, W78-07299 5D
- GORMLY, J. R.**  
Nonpoint Nitrate Contamination of Ground Water in Merrick County, Nebraska, W78-07506 5B
- GORSKI, W.**  
Investigation of Oil Pollution on the Polish Baltic Coast in 1974/1975 (In Polish), W78-07265 5B
- GOSSETT, J. M.**  
Effect of Thermal Pretreatment on Digestibility and Dewaterability of Organic Sludges, W78-07457 5D
- GOYAL, S. M.**  
Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater, W78-07463 5F
- GREEP, L. A.**  
Water/Wastewater Survey Guidelines, W78-07522 5A
- GRIFFITH, G. T.**  
Rotating Disc Sewage Treatment Systems for Suburban Developments and High-Density Resorts of Hawaii, W78-07393 5D
- GRIMMER, G.**  
Sedimentary Record of Heavy Metals and Polycyclic Aromatic Hydrocarbons in Lake Constance (In German), W78-07307 5B
- GROMIEC, M. J.**  
Industrial Waste Management in the Dairy Industry in Poland, W78-07590 5D
- GROMOV, V. V.**  
Role of Plankton in the Behavior of TC99 and MN54 in Seawater, W78-07286 5C
- GROSCH, D. S.**  
A Comparative Study of the Effects of Mercuric Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, *Artemia Salina*, W78-07668 5C
- GROSS, T. A.**  
Innovative Management Concept for Planning, W78-07222 5G
- GROVE, D. B.**  
The Use of Galerkin Finite-Element Methods to Solve Mass-Transport Equations, W78-07354 5B
- GRUGER, E. H. JR.**  
Pollution in the Northeast Pacific Ocean, W78-07325 5B
- GULLIVER, J. S.**  
Effluent Mixing Zone in a Shallow River, W78-07483 5B
- GUMBARDO, R.**  
Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut, W78-07334 5A
- GUNNER, H. B.**  
The Relationship of Lake Quality to Specific Urbanization Stresses, W78-07204 5C
- GUPTA, S. K.**  
Theoretical and Experimental Observations of Water and Nitrate Movement Below a Crop Root Zone, W78-07615 5B
- GURVICH, YE. G.**  
Composition of Suspensions and Sediments in the Estuaries of the Northern Dvina, Mezen', Pechora, and OB' Rivers, W78-07405 2L
- HAAG, R.**  
Sludge Disposal: The Problem, The Search, The Solution, W78-07424 5D
- HALE, A.**  
Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Pacific Northwest Region Case Studies), W78-07569 6G
- HALL, H.**  
Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Rocky Mountain Region Case Studies), W78-07568 6G
- HALL, H.**  
Treatment and Use of Sewage Purification Plant Sludges, W78-07425 5D
- HAMILTON, H. E.**  
Performance of a Trickling Filter, Solids Removal, and Anaerobic Digestion System for Recycled Poultry Manure Wastewater, W78-07207 5D
- HANKS, R. J.**  
Field Evaluation of Sprinkler Irrigation for Management of Irrigation Return Flow, W78-07618 5G
- HANN, R. W. JR.**  
Modeling Salinity of Irrigation Return Flow Where Sources and Sinks are Present, W78-07617 5B
- HANN, R. W. JR.**  
Environmental Management of a Ship Channel-Harbor Complex, W78-07539 5B
- HANSEN, D. V.**  
Technical and Philosophical Aspects of Ocean Disposal, W78-07540 5E
- HANSEN, D. V.**  
Circulation. MESA New York Bight Atlas Monograph 3, W78-07541 2L
- HARBINSON, R. W.**  
Model Tests of Circular Sewage Sedimentation Tanks, W78-07468 5D
- HARENBERG, W. A.**  
Water Resources of the Weiser River Basin, West-Central Idaho, W78-07342 4A
- HARGER, B. W. W.**  
An In Situ Study of Recruitment, Growth and Survival of Subtidal Marine Algae: Techniques and Preliminary Results, W78-07308 5C
- HARGROVE, R.**  
Effect of Irrigation Systems on Water Use Efficiency and Soil Water Solute Concentrations, W78-07620 5G
- HARGROVE, R. S.**  
Effect of Three Irrigation Systems on Distribution of Fertilizer Nitrate Nitrogen in Soil, W78-07610 5B
- HARRIS, A.**  
Problem Identification and Ranking. An Assessment of a River Basin Planning Process, W78-07687 6B
- HART, B. T.**  
A New Dialysis-Ion Exchange Technique for Determining the Forms of Trace Metals in Water, W78-07277 5A
- HART, E. D.**  
Positioning Techniques and Equipment for U. S. Army Corps of Engineers Hydrographic Surveys, W78-07676 7B
- HARTE, J.**  
Energy and Water, W78-07508 6D
- HARTMAN, R. B.**  
New Procedure Determines Aerobic Sludge Stability, W78-07464 5D
- HARTWIG, E. O.**  
The Impact of Nitrogen and Phosphorus Release from a Siliceous Sediment on the Overlying Water, W78-07302 5C
- HATA, K.**  
Concentration of Acetic Acid in Sulfite Pulp Evaporation Drain by Reverse Osmosis, W78-07598 5D
- HATTULA, M. L.**  
A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem, W78-07667 5A
- HAUG, R. T.**  
Effect of Thermal Pretreatment on Digestibility and Dewaterability of Organic Sludges, W78-07457 5D
- HAUG, R. T.**  
Los Angeles Faces Several Sludge Management Problems, W78-07448 5D
- HAUGEN, R. K.**  
Land Use and Pollution Patterns on the Great Lakes, W78-07288 5B
- HAUTALA, E.**  
Binding of Heavy Metal Ions by Formaldehyde-Polymerized Peanut Skins, W78-07594 5D

# AUTHOR INDEX

HAUTALA, E.

HAZEL, C.

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Case Studies), W78-07566 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Executive Summary), W78-07564 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish Wildlife, Part B: California (Final Report), W78-07565 6G

HEADSTREAM, M.

Make Wastewater More Versatile: Reuse it for Recreation Lakes, W78-07217 5D

HEBERLE, R. A.

Process for Clarification of Oil-Containing Waste, W78-07248 5D

HEDSTROM, W. E.

Economic and Agronomic Effects of High Irrigation Levels on Alfalfa and Barley, W78-07397 3F

HEISEY, W. A.

Process for Treating Wool Scouring Wastes, W78-07249 5D

HELD, G.

Variability of Hailstorms on the South African Plateau, W78-07507 2B

HELDAL, M.

Characterization of Sulphate Uptake in Anaerobic Nidulans, W78-07304 5C

HELSETH, J. M.

Surface Drifter Movements Observed in Outer Strait of Juan de Fuca, July 1977, W78-07545 5B

HELVIG, O. J.

Economic Impact of Water Quality on River Basin Management, W78-07396 5G

HENDERSON-SELLERS, B.

Forced Plumes in a Stratified Reservoir, W78-07489 8B

HENNINGER, D. L.

Floodplain Delineation Using LANDSAT-1 Data, W78-07510 4A

HERLYN, M.

Stability in Drinking and Surface Water of Nine Virus Species from Different Genera (In German), W78-07272 5C

HERRERA, S.

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Case Studies), W78-07566 6G

HEUSSER, C. J.

North American Glacial History Extended to 75,000 Years Ago, W78-07372 2C

HILL, D. W.

West Point Lake Postimpoundment Study, W78-07287 5C

HINTERBERGER, J.

Detoxification of Staphylococcal-Enterotoxin B in Water (In German), W78-07232 5F

HIRSHBURG, R. I.

The Effects of Diurnal Mixing on Thermal Stratification of Static Impoundments, W78-07210 2H

HOFFMAN, D. L.

Field Measured Flux of Volatile Denitrification Products as Influenced by Soil Water Content and Organic Carbon Source, W78-07613 5G

HOHN, C. M.

Application of Modern Irrigation Technology in the Mesilla Valley, New Mexico, W78-07634 3C

HOLBURN, M. B.

The 1973 Agreement on Colorado River Salinity Between the United States and Mexico, W78-07643 6E

HOLLEY, E. R.

Circumferential Diffusion in Pipe Mixing, W78-07488 8B

HOOD, D. R.

The South Dakota Cooperative Land Use Effort: A State Level Remote Sensing Demonstration Project, W78-07315 4A

HORACK, G.

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Executive Summary), W78-07563 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Final Report), W78-07567 6G

HORAK, G.

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Rocky Mountain Region Case Studies), W78-07568 6G

HORNER, G. L.

An Economic Analysis of Irrigation Return Flow Recycle Systems in the Central Valley of California, W78-07625 5G

Evaluation of Surface Irrigation Return Flows in the Central Valley of California, W78-07624 5B

HORNSBY, A. G.

The Role of EPA's Office of Research and Development in Irrigated Crop Production Research, W78-07607 5G

HORTON, M.

The '208' Planning Effort for Irrigated Agriculture in the State of Washington, W78-07642 5G

Irrigation Return Flow Problems in Yakima Valley, W78-07640 5G

The Sulphur Creek Pilot Project: A Practical Approach to Control of Pollutants Leaving Irrigated Farmlands, W78-07641 5G

HOUGHTON, R. W.

A Simple Model for Cross-Shelf Mixing on the Scotian Shelf, W78-07366 2L

HOVAK, G.

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Pacific Northwest Region Case Studies), W78-07569 6G

HOWARTH, C. M.

The Thickening and Centrifuging of Sludge, W78-07436 5D

HOWELL, H. O.

The Use of Filterbelt Presses for Dewatering of Sewage Sludges, W78-07426 5D

HOWELLS, D. H.

Summary Report - The Chowan River Project, W78-07318 5C

HOWSE, H. D.

Some Parasites and Diseases of Estuarine Fishes in Polluted Habitats of Mississippi, W78-07546 5C

HUBER, M. J.

Multiple Tensiometer Flushing System, W78-07499 2G

HUDSPETH, R. T.

Linear and Nonlinear Wave Action Estimates, W78-07485 2L

HUGHES, R. M.

Temperature Requirements of Salmonids in Relation to Their Feeding, Bioenergetics, Growth and Behavior, W78-07322 5C

HULBERG, L. W.

Patterns of Succession in Benthic Infaunal Communities Following Dredging and Dredged Material Disposal in Monterey Bay, W78-07677 5C

HUNT, A. S.

Sediment Thicknesses, Eastern Lake Champlain, W78-07686 2J

HUNTER, E. J.

Moisture Sensing Apparatus and Method, W78-07242 3F

HUSTON, M. T.

Preservation of Phenolic Compounds in Wastewaters, W78-07586 5D

HUSZAR, P.

A Process for Identifying, Evaluating and Implementing Solutions for Irrigation Return Flow Problems, W78-07654 5G

ICHIKI, Y.

Night Soil Treatment by 'Denipac Process'-Kawamuko Treatment Plant, Matsue City (2)



# AUTHOR INDEX

KLAER, F. H. JR.

- (Denipakku purosusu ni yoru shinyo shori-mat-sue shi kawamulo shorijo),  
W78-07478 5D
- MAFUKU, H.  
Anaerobic ATP Levels in the Blue-Green Alga Anabaena: Dark-Light Transients and Effects of Light Intensity,  
W78-07303 5C
- INOUE, M.  
Environmental Considerations Relating to Operation and Maintenance of the Texas Gulf Intracoastal Waterway,  
W78-07538 2L
- IOSTOVETSKII, YA. K.  
Hygienic Evaluation of Effectiveness of Urban Sewage Purification in Oxidation Ponds (In Russian),  
W78-07270 5D
- ISAAC, P. C. G.  
Treatment of Some Industrial Effluents in Malaysia,  
W78-07602 5D
- ISAVENKO, E. P.  
Investigation of Snow Control Systems on an Avalanche Slope,  
W78-07375 4A
- ISKANDAR, I. K.  
Reclamation of Wastewater by Application on Land,  
W78-07519 5D
- ITALIANO, M. L.  
Marine Waste Disposal in the New York Bight: Public Policy, Environmental Impacts, and Alternative Futures,  
W78-07529 5E
- ITO, R.  
Kinetic Studies on the Lime Sulfurated Solution (Calcium Polysulfide) Process for Removal of Heavy Metals from Waste Water,  
W78-07595 5D
- IVES, J.  
Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Case Studies),  
W78-07566 6G
- JACKSON, G. A.  
Trace Metal-Chelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations,  
W78-07663 5C
- JACOBS, J. J.  
Economic and Agronomic Effects of High Irrigation Levels on Alfalfa and Barley,  
W78-07397 3F
- JAHNSEN, K. W.  
Method for Purification of Industrial Waste Water,  
W78-07247 5D
- JAISWAL, C. S.  
Flow to a Nonpenetrating Well in a Leaky Artesian Aquifer with Variable Discharge,  
W78-07378 2F
- JAKUCZUN, B.  
Investigation of Oil Pollution on the Polish Baltic Coast in 1974/1975 (In Polish),  
W78-07265 5B
- JAMES, W. P.  
Environmental Considerations Relating to Operation and Maintenance of the Texas Gulf Intracoastal Waterway,  
W78-07538 2L
- JANATUINEN, J.  
A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem,  
W78-07667 5A
- JANK, B. E.  
Nitrification Systems with Integrated Phosphorus Precipitation,  
W78-07450 5D
- JENNER, C.  
Appendix E to Correlation of Dual-Channel Airborne IR Data with Soil Moisture Measurements,  
W78-07383 2G
- JENNINGS, M. E.  
Downstream-Upstream Reservoir Routing,  
W78-07344 4A
- JENSEN, M. E.  
Scientific Irrigation Scheduling for Salinity Control of Irrigation Return Flow,  
W78-07621 5G
- JOHNOVA, V.  
Preliminary Tests of the Influence of Waste Waters from Sugar Factories on the Numbers of Intestinal Bacteria in Water (In German),  
W78-07223 5C
- JOHNSON, J. S. JR.  
Cross-Flow Filtration in Physical-Chemical Treatment of Municipal Sewage Effluents,  
W78-07533 5D
- JOHNSTONE, W. R.  
Local Solutions to Drainage Problems,  
W78-07638 4A
- JONES, H. H.  
The Behavior of F2 Coliphage in Activated Sludge Treatment,  
W78-07461 5D
- JOSEPH, J.  
Hyacinths for Wastewater Treatment,  
W78-07442 5D
- JUMIKIS, A. R.  
Dielectric Constant and Electroconductance of Some Dry Frost-Prone Soils,  
W78-07369 2C
- JUNK, G. A.  
Analysis of Various Iowa Waters for Selected Pesticides: Atrazine, DDE, and Dieldrin--1974,  
W78-07331 5A
- KADLEC, J. A.  
Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland,  
W78-07279 5C
- KADLEC, R. H.  
Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland,  
W78-07279 5C
- KAMIZAWA, C.  
Concentration of Acetic Acid in Sulfite Pulp Evaporation Drain by Reverse Osmosis,  
W78-07598 5D
- KANEHIRO, B. Y.  
Groundwater Recharge and Coastal Discharge for the Northwest Coast of the Island of Hawaii: A Computerized Water Budget Approach,  
W78-07394 2F
- KARICKHOFF, S. W.  
Protonation of Organic Bases in Clay-Water Systems,  
W78-07364 5B
- KARIM, F. II  
Flood Damages on the Iowa River,  
W78-07258 4A
- KARMELI, D.  
Water Distribution Patterns for Sprinkler and Surface Irrigation Systems,  
W78-07631 3F
- KARRICK, N. L.  
Pollution in the Northeast Pacific Ocean,  
W78-07325 5B
- KATO, O.  
Method for Clarifying Waste Water Containing Finely Divided Oily Materials,  
W78-07245 5D
- KAUFMAN, M. I.  
Uranium-Isotope Variations in Groundwaters of the Floridan Aquifer and Boulder Zone of South Florida,  
W78-07343 5B
- KAVANAUGH, M. C.  
Phosphorus Removal by Precipitation with Fe (III),  
W78-07465 5D
- KEELEY, J. W.  
Nutrient, Bacterial, and Virus Control as Related to Ground Water Contamination,  
W78-07571 5B
- KERR, R. D.  
Water Quality Model for the Upper North Platte River,  
W78-07206 5B
- KIMMEL, L. V.  
A Generalized Water Quality Model for Eutrophic Lakes and Reservoirs,  
W78-07290 5C
- KIMURA, H.  
A Pilot Plant Study on Advanced Treatment of Treated Sewage for Re-Use, (In Japanese),  
W78-07445 5D
- KING, P. B.  
Operational Experience at the Borchers Quarry Wastewater Treatment Works,  
W78-07433 5D
- KINNEY, W.  
An Economic Analysis of Irrigation Return Flow Recycle Systems in the Central Valley of California,  
W78-07625 5G
- KIRKHAM, D.  
Porous Media Tests of Groundwater Mounds,  
W78-07387 2F
- KLAER, F. H. JR.  
How to Meet Well Project Goals: Part I,  
W78-07581 4B

# AUTHOR INDEX

KNUTSEN, G.

KNUTSEN, G.  
Characterization of Sulphate Uptake in Ana-  
cystis Nidulans,  
W78-07304 5C

KOBUS, H.  
Unified Presentation of Weir-Aeration Data,  
W78-07494 2E

KOOPMAN, B. L.  
Nuisance-Algae Control Through Mechanical  
Harvesting,  
W78-07266 5G

KORTE, R.  
Detoxification of Staphylococcal-Enterotoxin  
B in Water (In German),  
W78-07232 5F

KRAMER, T. T.  
Monitoring of Waters for Bdellovibrio Bac-  
teriovorus - A Parasite of Gram Negative Enter-  
ic Bacteria Present in Sewage,  
W78-07323 5A

KRAPU, G. L.  
Productivity of Red-Winged Blackbirds in  
Prairie Pothole Habitat,  
W78-07339 2I

KRAUS, K. A.  
Cross-Flow Filtration in Physical-Chemical  
Treatment of Municipal Sewage Effluents,  
W78-07533 5D

KREJCI, V.  
Phosphorus Removal by Precipitation with FE  
(III),  
W78-07465 5D

KRULL, D. L.  
An Assessment of Irrigation Efficiencies and  
Drainage Return Flows from the Wellton-  
Mohawk Division of the Gila Project,  
W78-07644 3C

KSENZHEK, O. S.  
The Effect of the Ionic Composition of the En-  
vironment on Oxygen Exchange in the Alga  
Acetabularia (In Russian),  
W78-07213 5C

KUHNER, J.  
Urban Runoff Pollution Control--State-of-the-  
Art,  
W78-07335 5G

KUNKEL, R.  
Nitrogen and Water Management to Minimize  
Return-Flow Pollution from Potato Fields of  
the Columbia Basin,  
W78-07611 5G

KUPRIANOV, V. V.  
Methods for Calculating Maximum Flood  
Discharges for Natural Watercourses and  
Urban Areas in the U.S.S.R.,  
W78-07697 2A

L'VOVICH, M. I.  
Transformation of the Hydrologic Budget of  
the Moscow City Area,  
W78-07376 4C

LACASSE, S. M.  
Sizing of Containment Areas for Dredged  
Material,  
W78-07674 5E

LACLAIR, L. M.  
New System Cuts Phosphorus for Less Cost,  
W78-07301 5D

LAMB, B. L.  
Instream Flow Decision-Making in the Pacific  
Northwest,  
W78-07480 6E

LAMBE, W. T.  
Sizing of Containment Areas for Dredged  
Material,  
W78-07674 5E

LAMM, W. T.  
Problem Identification and Ranking. An As-  
sessment of a River Basin Planning Process,  
W78-07687 6B

LANE, E. F.  
Improvements for Little River Inlet, South  
Carolina; Hydraulic Model Investigation,  
W78-07671 8B

LANGLINAIS, S. J.  
Greenhouse Studies of the Growth and  
Reproduction of Egeria Densa,  
W78-07401 4A

LANSFORD, R. R.  
Economics of Controlling Irrigation Return  
Flow in the Mesilla Valley, New Mexico,  
W78-07635 5G

LARSEN, V.  
Nitrogen Transformation in Lakes,  
W78-07262 5C

LAW, I. B.  
Problems Encountered in the Up-Grading of  
Some Small Sewage Works,  
W78-07427 5D

LAW, J. P. JR.  
The Role of EPA's Office of Research and  
Development in Irrigated Crop Production  
Research,  
W78-07607 5G

LAWLESS, E. J.  
PVC Pipe Passes Performance and Cost Tests,  
W78-07479 8G

LAYTON, J. J.  
A Process for Identifying, Evaluating and Im-  
plementing Solutions for Irrigation Return Flow  
Problems,  
W78-07654 5G

LEGGETT, D. C.  
Reclamation of Wastewater by Application on  
Land,  
W78-07519 5D

LESCHACK, L. A.  
Appendix E to Correlation of Dual-Channel  
Airborne IR Data with Soil Moisture Measure-  
ments,  
W78-07383 2G

LETTER, J. V. JR.  
Physical Hydraulic Models: Assessment of Pre-  
dictive Capabilities; Report 2, Movable-Bed  
Model of Galveston Harbor Entrance,  
W78-07672 8B

LEWIS, E. L.  
Salinity: Its Definition and Calculation,  
W78-07367 2K

LEWIS, G. C.  
On-Farm Method for Controlling Sediment and  
Nutrient Losses,  
W78-07626 5G

LEWIS, J. L.  
Appendix E to Correlation of Dual-Channel  
Airborne IR Data with Soil Moisture Measure-  
ments,  
W78-07383 2G

LEWIS, M.  
Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Executive Summary),  
W78-07563 6G

Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest (Final  
Report),  
W78-07567 6G

Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Pacific Northwest Region Case Studies),  
W78-07569 6G

Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Rocky Mountain Region Case Studies),  
W78-07568 6G

LEWIS, W. M.  
Use of Zooplanktophagic Fishes in Channel  
Catfish Production Ponds,  
W78-07292 5C

LIGHTSEY, G. R.  
Adsorption of Textile Dyes by Activated Car-  
bon Produced from Agricultural, Municipal and  
Industrial Wastes,  
W78-07599 5D

LINDEBERG, K. H.  
Economic Analysis of On-Farm Methods for  
Controlling Sediment and Nutrient Losses,  
W78-07627 5G

LINDH, G.  
Urban Hydrological Modeling and Catchment  
Research in Sweden,  
W78-07695 2A

LINS, H. F. JR.  
Land Use and Environmental Assessment in  
the Central Atlantic Region,  
W78-07317 4A

LINSTEDT, K. D.  
New Procedure Determines Aerobic Sludge  
Stability,  
W78-07464 5D

LITTLER, M. M.  
Ecological Components Structuring the  
Seaward Edges of Tropical Pacific Reefs: The  
Distribution, Communities and Productivity of  
Porolithothamnion,  
W78-07327 2I

LIU, D. L.  
Measuring Petroleum Hydrocarbons in  
Digested Sewage Sludges,  
W78-07462 5A

LOH, P. C.  
Recycling of Water for Irrigation: Persistence  
of Enteroviruses in Sewage Effluent and Natu-  
ral Waters Receiving the Effluent,  
W78-07471 5B

LONG, R. B.  
Economic A  
Controlling  
W78-07627

LORENZEN,  
A General  
Eutrophic L  
W78-07290

LOSEV, E. D.  
Dam of the  
W78-07511

LOUCKS, D.  
Nonstructu  
W78-07221

LOWING, M.  
Urban Hy  
Research in  
W78-07698

LUBCHENCO,  
Plant Spec  
Community  
Preference  
W78-07341

LUECKE, R.  
Particle Di  
W78-07321

LUMSDEN,  
Sewage Pu  
W78-07250

LUND, L. J.  
Variability  
Managemen  
W78-07612

LYKKEN, G.  
Determina  
Coulee Sy  
nite Burni  
W78-07208

MACH, R.  
Plants and  
Sludges in  
State of  
Syste  
serschlaen  
Deutschla  
W78-07444

MACHEMER,  
Comparis  
Models fo  
W78-07474

MACINA, C.  
Detection  
Streams i  
W78-07333

MACINTYRE,  
Theoretic  
Water an  
Root Zon  
W78-07666

MACLENNAN,  
Wastewa  
pose,  
W78-07474

MACLEOD,  
Future T  
W78-07474

# AUTHOR INDEX

MCNEAL, B. L.

- LONG, R. B.**  
Economic Analysis of On-Farm Methods for Controlling Sediment and Nutrient Losses, W78-07267 5G
- LORENZEN, M. W.**  
A Generalized Water Quality Model for Eutrophic Lakes and Reservoirs, W78-07290 5C
- LOSEV, E. D.**  
Dam of the Kolyma Hydroelectric Power Plant, W78-07511 8D
- LOUCKS, D. P.**  
Nonstructural Floodplain Planning, W78-07221 6F
- LOWING, M. J.**  
Urban Hydrological Modeling and Catchment Research in the United Kingdom, W78-07698 2A
- LUBCHENCO, J.**  
Plant Species Diversity in a Marine Intertidal Community: Importance of Herbivore Food Preference and Algal Competitive Abilities, W78-07341 2L
- LUECKE, R. H.**  
Particle Disruption in Flocculating Systems, W78-07321 5F
- LUMSDEN, R. W.**  
Sewage Purification System, W78-07250 5D
- LUND, L. J.**  
Variability of Nitrate Leaching Within Defined Management Units, W78-07612 5B
- LYKKEN, G. I.**  
Determination of Trace Elements in the English Coulee System: Presence Due to Extended Lignite Burning, W78-07208 5A
- MACH, R.**  
Plants and Systems for Composting of Sewage Sludges in the Federal Republic of Germany--State of the Art and Trends (Anlagen und Systeme zur Kompostierung von Abwässerschlämmen in der Bundesrepublik Deutschland--Stand sowie Tendenzen), W78-07449 5E
- MACHEMEHL, J. L.**  
Comparison of Numerical Simulation Flow Models for Coastal Inlets, W78-07472 2L
- MACINA, G.**  
Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut, W78-07334 5A
- MACINTYRE, J. L.**  
Theoretical and Experimental Observations of Water and Nitrate Movement Below a Crop Root Zone, W78-07615 5B
- MACLENNAN, R. G.**  
Wastewater Effluent Line Serves Dual Purpose, W78-07419 5E
- MACLEOD, D. C.**  
Future Treatment Plant Requirements, W78-07474 5D
- MAGUIRE, L. A.**  
COPEPOD4: A Discrete Time-Delay Model of Copepod Population Dynamics, W78-07289 5B
- MAHLMAN, H. A.**  
Cross-Flow Filtration in Physical-Chemical Treatment of Municipal Sewage Effluents, W78-07533 5D
- MAHNEL, H.**  
Stability in Drinking and Surface Water of Nine Virus Species from Different Genera (In German), W78-07272 5C
- MALININA, T. I.**  
Dynamics of Lake Onega Waters, W78-07501 2H
- MAPLES, G.**  
The Effects of Diurnal Mixing on Thermal Stratification of Static Impoundments, W78-07210 2H
- MARKOVSKY, M.**  
Unified Presentation of Weir-Aeration Data, W78-07494 2E
- MARLAR, T. L.**  
Land Use and Pollution Patterns on the Great Lakes, W78-07288 5B
- MARR, W. A.**  
Sizing of Containment Areas for Dredged Material, W78-07674 5E
- MARTIG, K. W. JR.**  
Flow Monitoring Apparatus, W78-07236 5D
- MASSING, H.**  
Urban Hydrology Studies and Mathematical Modeling in the Federal Republic of Germany, W78-07696 2A
- MASTERS, J. E.**  
Case Note: Water and Water Courses -- Limiting the Reservation Doctrine. Mimbres Valley Irrigation Co. v. Salopek, 564 P.2d 615(N.M.1977), cert.granted, 46U.S.L.W. 3426(No.77-510), W78-07211 6E
- MASUDA, H.**  
Concentration of Acetic Acid in Sulfite Pulp Evaporation Drain by Reverse Osmosis, W78-07598 5D
- MATTSON, C. D.**  
Effect of the Small Watershed Program on Major Uses of Land: Examination of 60 Projects in the Southeast, Mississippi Delta, and Missouri River Tributaries Regions, W78-07330 4D
- MATTSSON, S.**  
Medically Used Radionuclides in Sewage Sludge, W78-07460 5A
- MAYER, J. R.**  
Benthic Semi-Barrier to Control the Growth of Weeds in Aquatic Environments, W78-07257 5G
- MAYS, L. W.**  
State Variable Model for Sewer Network Flow Routing, W78-07212 8B
- MAYSTRENKO, YU. G.**  
Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C
- MCANALLY, W. H. JR.**  
Model Study of Cool Water Discharge from Proposed LNG Facility, Los Angeles Harbor, California, W78-07669 5B
- Physical Hydraulic Models: Assessment of Predictive Capabilities; Report 2. Movable-Bed Model of Galveston Harbor Entrance, W78-07672 8B
- MCCARTY, P. L.**  
Effect of Thermal Pretreatment on Digestibility and Dewaterability of Organic Sludges, W78-07457 5D
- MCDONALD, G.**  
Binding of Heavy Metal Ions by Formaldehyde-Polymerized Peanut Skins, W78-07594 5D
- MCDONALD, R. C.**  
Water Hyacinths and Alligator Weeds for Final Filtration of Sewage, W78-07299 5D
- MCGINTY, H. K. III.**  
Land Use and Environmental Assessment in the Central Atlantic Region, W78-07317 4A
- MCHUGH, G. F.**  
Development of a Two Dimensional Hydrodynamic Numerical Model for Use in a Shallow, Well-Mixed Estuary, W78-07408 2L
- MCKIM, H. L.**  
Land Use and Pollution Patterns on the Great Lakes, W78-07288 5B
- MCLAUGHLIN, D. K.**  
Hydraulic Modeling of Mixing in Stratified Lakes, W78-07218 5B
- MCLEOD, R. A.**  
A Coring and Squeezing Technique for the Detailed Study of Subsurface Water Chemistry, W78-07575 2K
- MCMASTER, G. M.**  
On-Farm Method for Controlling Sediment and Nutrient Losses, W78-07626 5G
- MCMURTY, G. J.**  
Floodplain Delineation Using LANDSAT-1 Data, W78-07510 4A
- MCNABB, J. F.**  
Nutrient, Bacterial, and Virus Control as Related to Ground Water Contamination, W78-07571 5B
- MCNEAL, B. L.**  
Nitrogen and Water Management to Minimize Return-Flow Pollution from Potato Fields of the Columbia Basin, W78-07611 5G

# AUTHOR INDEX

**MCPHERSON, M. B.**

**MCPHERSON, M. B.**

Urban Hydrological Modeling and Catchment Research in the U.S.A., W78-07700 2A

Urban Hydrological Modeling and Catchment Research: International Summary, W78-07689 2A

**MCWHORTER, D. B.**

Artificial Ground-Water Recharge with Capillarity, W78-07365 4B

Modeling Salt Transport in the Irrigated Soils of Grand Valley, W78-07648 5B

Rate of Ammonium Nitrification and Nitrate Leaching in Soil Columns, W78-07520 5B

Salt Loading in Disturbed Watershed-Field Study, W78-07484 5B

**MELAMED, D.**

Modeling Salinity of Irrigation Return Flow Where Sources and Sinks are Present, W78-07617 5B

**MELHUUS, A.**

A Preliminary Study of the Use of Benthic Algae as Biological Indicators of Heavy Metal Pollution in Sorfjorden, Norway, W78-07665 5A

**MELNICK, J.**

Viruses in Water: The Increasing Urgency of the Problem and Approaches to its Solution (In Russian), W78-07261 5G

**MELNICK, J. L.**

Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater, W78-07463 5F

**MERRILL, G.**

How the NPDES Program Will Define Present Water Quality Conditions, W78-07637 5G

**MERRILL, G. F.**

The 1973 Bathymetric Survey in the New York Bight Apex: Maps and Geological Implications, W78-07548 2L

**MERZ, W.**

Determination of Total Organic Carbon in Potable Water, Sewage, Industrial Effluents, and Boiler Feed Water, W78-07404 5A

**MESHAI, A. H.**

The Problem of the Salinity Increase in Lake Qarun (Egypt) and a Proposed Solution, W78-07305 5C

**MEYER, G.**

Detoxification of Staphylococcal-Enterotoxin B in Water (In German), W78-07232 5F

**MEYERS, F.**

Contaminating Spill Detection Arrangement, W78-07241 5A

**MICHALOVIC, J. G.**

Suggested Method for Vanadate Removal from Mill Effluents, W78-07332 5D

**MICHALSON, E. L.**

An Attempt to Quantify the Esthetics of Wild and Scenic Rivers in Idaho, W78-07220 6B

Economic Analysis of On-Farm Methods for Controlling Sediment and Nutrient Losses, W78-07627 5G

**MIDDELBEEK, C. G.**

Device for Collecting Light-Weight Substances Floating on a Liquid Surface, W78-07253 5G

**MIELE, R. P.**

Independent Physical-Chemical Treatment of Raw Sewage, W78-07516 5D

**MIKLOSOVICOVA, L.**

Microbiological Aspects of Pollution and Self-Purification of the Water of the River Danube on its Czechoslovak Section (In German), W78-07267 5C

**MILLER, B. S.**

Nearshore Fish and Macroinvertebrate Assemblages Along the Strait of Juan de Fuca Including Food Habits of Nearshore Fish, W78-07543 2L

**MILLER, G. W.**

European Water Treatment Practices and What We Can Learn from Them, W78-07604 5F

**MILLER, M. A.**

Air vs 02: Two Activated Sludge Systems Compared, W78-07451 5D

**MILLER, P. J.**

Two-Dimensional Plume in Uniform Ground-Water Flow, W78-07490 5B

**MILLER, R. J.**

Evaluation of Surface Irrigation Return Flows in the Central Valley of California, W78-07624 5B

**MILLER, W. B.**

Effect of Time of Deacetylation on Molecular Weight Distribution, Acetyl Content, Viscosity, and Performance of Chitsan as a Conditioning Agent for Activated Sludge, W78-07552 5D

**MINK, J. F.**

Handbook-Index of Hawaii Groundwater and Resources Data, Extracted from Reports of the Water Resources Research Center, University of Hawaii, Volume I, W78-07395 7C

**MITCHELL, D. H.**

The Production of Protein from Municipal Sludge, W78-07447 5D

**MITCHELL, M.**

Adsorption of Textile Dyes by Activated Carbon Produced from Agricultural, Municipal and Industrial Wastes, W78-07599 5D

**MITTAL, M. K.**

Drag on Baffle Walls in Hydraulic Jump, W78-07491 8B

**MIYAMOTO, S.**

Effects of Wetting Agents on Water Infiltration into Water-Repellent Coal Mine Spoils, W78-07370 5G

**MONEVA, M.**

Mercury Pollution of Water (In Bulgarian), W78-07268 5B

**MOORE, K. A.**

City of Newport News and Fort Eustis Tidal Marsh Inventory, W78-07224 2L

**MOORE, R. J.**

Some Properties of Variance Reduction Techniques Where Hydrological Extremes Are Estimated by Monte Carlo Simulation, W78-07391 2E

**MOORE, R. L.**

Packers and Seals Serve Many Uses, W78-07585 8C

**MORA, B.**

IBM 1130 Computation Process in the Study of Biophysical Constants Variations of Pathogenic Bacteria by Phytoplankton, W78-07264 5C

**MOREL, F. M. M.**

Copper Sensitivity of *Gonyaulax Tamarensis*, W78-07664 5C

**MORETTI, P. M.**

Hydraulic Modeling of Mixing in Stratified Lakes, W78-07218 5B

**MORGAN, J. J.**

Trace Metal-Chelator Interactions and Phytoplankton Growth in Seawater Media: Theoretical Analysis and Comparison with Reported Observations, W78-07663 5C

**MORGAN, W. S. G.**

The Dangers of Inadequate Chlorination of Polluted Waters, W78-07435 5D

**MOROZOV, N. P.**

Composition of Suspensions and Sediments in the Estuaries of the Northern Dvina, Mezen', Pechora, and Ob' Rivers, W78-07405 2L

**MORRIS, I.**

Photorespiration in Marine Phytoplankton, W78-07309 5C

**MORRISON, R.**

Monitoring in the Zone of Aeration, W78-07470 5A

**MORSE, W. L.**

The Dishonest Method in Stream Temperature Modeling, W78-07392 2D

**MOSHIRE, G. A.**

Water-Column and Benthic Invertebrate and Plant Associations as Affected by the Physico-Chemical Aspects in a Mesotrophic Bayou Estuary Pensacola, Florida, W78-07203 5C

**MOUSAVI, S.-F.**

Porous Media Tests of Groundwater Mounds, W78-07387 2F



# AUTHOR INDEX

PAGE, W.

- MUDD, R. D.**  
A Generalized Water Quality Model for  
Eutrophic Lakes and Reservoirs,  
W78-07290 5C
- MUELLER, G.**  
Sedimentary Record of Heavy Metals and  
Polycyclic Aromatic Hydrocarbons in Lake  
Constance (In German),  
W78-07307 5B
- MUELLER, J. A.**  
Industrial Wastes, MESA New York Bight  
Atlas Monograph 30,  
W78-07547 5B
- MUKHETDINOV, N. A.**  
Effect of Nonlinear Air Filtration on Thermal  
Regime of Rock-Fill Dam,  
W78-07513 8D
- MULDER, J. J.**  
The Recovery of Protein From Potato Juice  
Waste Water by Foam Separation,  
W78-07592 5D
- MULINO, M. M.**  
The Impact of the 1975 Bonnet Carre Spillway  
Opening on Epifaunal Invertebrates in  
Southern Lake Pontchartrain,  
W78-07219 5C
- MURPHY, K. L.**  
Nitrification Systems with Integrated  
Phosphorus Precipitation,  
W78-07450 5D
- MURTHY, K. K.**  
Design of Constant Accuracy Linear Proportional  
Weir,  
W78-07492 8B
- MUSHA, M.**  
Method for Clarifying Waste Water Containing  
Finely Divided Oily Materials,  
W78-07245 5D
- MYKLESTAD, S.**  
A Preliminary Study of the Use of Benthic  
Algae as Biological Indicators of Heavy Metal  
Pollution in Sorfjorden, Norway,  
W78-07665 5A
- NAKANO, Y.**  
Theory and Numerical Analysis of Moving  
Boundary Problems in the Hydrodynamics of  
Porous Media,  
W78-07389 2F
- NAWARA, S.**  
The Research Works on Sewage Treatment in  
Poland,  
W78-07531 5D
- NEDACHIN, A. E.**  
The Effect of Chemicals on Some Microbial  
Self-Purification Processes in Bodies of Water  
(In Russian),  
W78-07298 5C
- NEHRING, N. L.**  
Analysis of Various Iowa Waters for Selected  
Pesticides: Atrazine, DDE, and Dieldrin-1974,  
W78-07331 5A
- NELSON, W.**  
Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Executive Summary),  
W78-07563 6G
- Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest (Final  
Report),  
W78-07567 6G**
- Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Pacific Northwest Region Case Studies),  
W78-07569 6G**
- Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Rocky Mountain Region Case Studies),  
W78-07568 6G**
- NEUFELD, R. D.**  
Ozonation of Coal Gasification Plant Waste-  
water,  
W78-07589 5A
- NEUSHUL, M.**  
An In Situ Study of Recruitment, Growth and  
Survival of Subtidal Marine Algae: Techniques  
and Preliminary Results,  
W78-07308 5C
- NICHOLLS, H. A.**  
Operating Activated-Sludge Plants to Effect  
Nutrient Removal,  
W78-07441 5D
- NIETO, T. P.**  
Method of Average Birth and Death Rate  
Evaluation in the Marine-Terrestrial Bacteria  
Interactions,  
W78-07263 5C
- NILSON, E. L.**  
Apparatus for Purifying Water,  
W78-07251 5F
- NITECKI, C.**  
Investigation of Oil Pollution on the Polish Bal-  
tic Coast in 1974/1975 (In Polish),  
W78-07265 5B
- NOBLE, S. M.**  
Use of Benthic Sediments as Indicators of  
Marina Flushing,  
W78-07553 5A
- NORMAND, D.**  
Urban Hydrological Modeling and Catchment  
Research in France,  
W78-07694 2A
- NUPEN, E. M.**  
The Dangers of Inadequate Chlorination of Pol-  
luted Waters,  
W78-07435 5D
- NYBAKKEN, J. W.**  
Patterns of Succession in Benthic Infaunal  
Communities Following Dredging and Dredged  
Material Disposal in Monterey Bay,  
W78-07677 5C
- O'CONNOR, D. J.**  
Water Quality. MESA New York Bight Atlas  
Monograph 27,  
W78-07542 5B
- OKHLOPKOVA, A. N.**  
Dynamics of Lake Onega Waters,  
W78-07501 2H
- OLIVER, J. S.**  
Patterns of Succession in Benthic Infaunal  
Communities Following Dredging and Dredged  
Material Disposal in Monterey Bay,  
W78-07677 5C
- ONKEN, A.**  
Effect of Three Irrigation Systems on Distribu-  
tion of Fertilizer Nitrate Nitrogen in Soil,  
W78-07610 5B
- ONKEN, A. B.**  
Effect of Irrigation Systems on Water Use Ef-  
ficiency and Soil Water Solute Concentrations,  
W78-07620 5G
- OPARA, J. U.**  
Inventory of Lake Ontario Inlets and Harbors:  
Niagara River to Stony Creek,  
W78-07225 2H
- ORTIZ, N. V.**  
Artificial Ground-Water Recharge with Capil-  
larity,  
W78-07365 4B
- OSMIN, W. L.**  
Groundwater Tracing with Post Sampling Ac-  
tivation Analysis Using Bromide and Iodide  
Ions Injected Simultaneously into a Shallow-  
Well System,  
W78-07683 5B
- OSMOND, J. K.**  
Uranium-Isotope Variations in Groundwaters  
of the Floridan Aquifer and Boulder Zone of  
South Florida,  
W78-07343 5B
- OSTER, J. D.**  
Hydro-Salinity Models: Sensitivity to Input  
Variables,  
W78-07632 5B
- OSWALD, W. J.**  
Nuisance-Algae Control Through Mechanical  
Harvesting,  
W78-07266 5G
- OTTIS, K.**  
Stability in Drinking and Surface Water of Nine  
Virus Species from Different Genera (In Ger-  
man),  
W78-07272 5C
- OUTCALT, S. I.**  
Appendix E to Correlation of Dual-Channel  
Airborne IR Data with Soil Moisture Measure-  
ments,  
W78-07383 2G
- OVERSTREET, R. M.**  
Some Parasites and Diseases of Estuarine  
Fishes in Polluted Habitats of Mississippi,  
W78-07546 5C
- PAERL, H. W.**  
The Relation Between Adenosine Triphosphate  
and Microbial Biomass in Diverse Aquatic  
Ecosystems,  
W78-07306 5C
- PAGAN, A. R.**  
Groundwater Law: The Riparian Problem,  
W78-07578 6F
- PAGE, W.**  
Physical-Chemical Methods for the Control of  
Algal Species and Composition in Algal Cultur-  
ing Facilities,  
W78-07324 5G

# AUTHOR INDEX

PAL, D.

- PAL, D.  
Identification of Alternative Power Sources for  
Dredged Material Processing Operations.  
W78-07680 8C

- PANDE, P. K.  
Drag on Baffle Walls in Hydraulic Jump.  
W78-07491 8B

- PARDO, J.  
A Test of the Effects of Domestic Sewage on  
the Growth of the Common Blue Mussel, *Mytilus Edulis*, in an Aquacultural System.  
W78-07205 5C

- PARKER, C. E.  
Identification of Alternative Power Sources for  
Dredged Material Processing Operations.  
W78-07680 8C

- PARKHURST, Z.  
Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part A:  
Rocky Mountains and Pacific Northwest  
(Pacific Northwest Region Case Studies).  
W78-07569 6G

- Assessment of Effects of Altered Stream Flow  
Characteristics on Fish and Wildlife, Part B:  
Rocky Mountains and Pacific Northwest  
(Rocky Mountain Region Case Studies).  
W78-07568 6G

- PARLANGE, J.-Y.  
Dispersion in Soil Columns: Effect of Bound-  
ary Conditions and Irreversible Reactions.  
W78-07386 2G

- PASSIVIRTA, J.  
A Five-Year Monitoring Study of the  
Chlorinated Hydrocarbons in the Fish of a Fin-  
nish Lake Ecosystem.  
W78-07667 5A

- PATTERSON, R. J.  
A Coring and Squeezing Technique for the  
Detailed Study of Subsurface Water Chemis-  
try.  
W78-07575 2K

- PAYTON, G. R.  
Total Organic Halogen as Water Quality  
Parameter: Adsorption/Microcoulometric  
Method.  
W78-07273 5A

- PENNER, I. L.  
Grouting Provides Economical and Effective  
Maintenance in Kansas.  
W78-07421 8G

- PENNIMAN, E. C.  
Distribution, Growth, and Phosphorus Rela-  
tionships of *Myriophyllum heterophyllum*  
Michx. in Lake Winnepesaukee, New  
Hampshire.  
W78-07482 5C

- PERKIN, R. G.  
Salinity: Its Definition and Calculation.  
W78-07367 2K

- PESCETTO, J. R.  
Traveling Sprinkler Guide Wheel Assembly.  
W78-07244 3F

- PETERKA, J. J.  
An Analytical Evaluation of the Utilization and  
Management of Water Resources in the Lake  
Metigoshe Watershed, North Dakota.  
W78-07209 5C

- PETERSEN, G. W.  
Floodplain Delineation Using LANDSAT-1  
Data.  
W78-07510 4A

- PETERSON, F. L.  
Groundwater Recharge and Coastal Discharge  
for the Northwest Coast of the Island of  
Hawaii: A Computerized Water Budget Ap-  
proach.  
W78-07394 2F

- PETROV, V. G.  
Dam of the Kolyma Hydroelectric Power Plant.  
W78-07511 8D

- PETRYNA, A.  
Investigation of Oil Pollution on the Polish Bal-  
tic Coast in 1974/1975 (In Polish).  
W78-07265 5B

- PILLAI, K. G.  
Design of Constant Accuracy Linear Propor-  
tional Weir.  
W78-07492 8B

- POIRRIER, M. A.  
The Impact of the 1975 Bonnet Carre Spillway  
Opening on Epifaunal Invertebrates in  
Southern Lake Pontchartrain.  
W78-07219 5C

- POLLART, G. M.  
Aeration Tube.  
W78-07237 3F

- POLLEY, R. D.  
Apparatus for Purifying Water.  
W78-07251 5F

- PRATT, P. F.  
Variability of Nitrate Leaching Within Defined  
Management Units.  
W78-07612 5B

- PRELLWITZ, D. M.  
Effects of Stream Channelization on Terrestrial  
Wildlife and Their Habitats in the Buena Vista  
Marsh, Wisconsin.  
W78-07228 6G

- PRICE, E. P.  
Agricultural Drainage Problems of the San  
Joaquin Valley.  
W78-07636 4A

- PRICE, J. D.  
Quality of Irrigation Return Flow from Flooded  
Rice Paddies.  
W78-07623 5B

- PRICE, P. L.  
Dye Infusion Technique Assesses Stream Pol-  
lution in Ohio.  
W78-07373 5B

- PRICE, R. T.  
Dye Infusion Technique Assesses Stream Pol-  
lution in Ohio.  
W78-07373 5B

- PRIVAL'SKIY, V. YE.  
Investigation of Level Fluctuations in Closed  
Bodies of Water on the Basis of Stochastic  
Models of the Elements of the Hydrologic  
Budget.  
W78-07500 2F

- PRUITT, D. E.  
Apparatus for Purifying Water.  
W78-07251 5F

- PRUITT, W. O.  
Evaluation of Surface Irrigation Return Flows  
in the Central Valley of California.  
W78-07624 5B

- RADER, J. J.  
Water Purifying Device Without Movable  
Mechanical Part in Contact with the Liquid to  
be Treated.  
W78-07252 5D

- RADOSEVICH, G. E.  
An Influent Control Approach to Irrigation  
Return Flow Quality Management.  
W78-07653 5G

- Interface of Water Quantity and Quality Laws  
in the West.  
W78-07652 6E

- A Process for Identifying, Evaluating and Im-  
plementing Solutions for Irrigation Return Flow  
Problems.  
W78-07654 5G

- RAM, N. M.  
Nitrification in Four Acidic Streams in  
Southern New Jersey.  
W78-07353 5C

- RAMASESHAN, S.  
Urban Hydrological Modeling and Catchment  
Research in India.  
W78-07690 2A

- RAMSEIER, R. O.  
Visual Observations of Floating Ice from  
Skylab.  
W78-07346 2C

- RANDALL, J. M.  
Binding of Heavy Metal Ions by Formal-  
dehyde-Polymerized Peanut Skins.  
W78-07594 5D

- RANKL, J. G.  
Rainfall and Runoff Data from Small Basins in  
Wyoming.  
W78-07349 7C

- RAO, P. S. C.  
Simulation of Nitrogen Movement, Transfor-  
mations, and Plant Uptake in the Root Zone.  
W78-07608 5B

- RASCHKE, R. L.  
West Point Lake Postimpoundment Study.  
W78-07287 5C

- RATKOVICH, D. YA.  
Investigation of Level Fluctuations in Closed  
Bodies of Water on the Basis of Stochastic  
Models of the Elements of the Hydrologic  
Budget.  
W78-07500 2F

- RAWLEY, R.  
Total Organic Halogen as Water Quality  
Parameter: Adsorption/Microcoulometric  
Method.  
W78-07273 5A

- REAGAN, S. P.  
Management of the Northern Chesapeake Bay  
American Shad Fishery.  
W78-07337 6B

- REAVIS, M. W.  
Environmental Management of a Ship Channel-  
Harbor Complex.  
W78-07539 5B

# AUTHOR INDEX

SCHORNICK, J. C. JR.

- RECTENWALD, H.**  
Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Case Studies), W78-07566 6G
- REED, T. E.**  
Water-Level Changes in Wells Along the West Side of the Cedar Creek Anticline, Southeastern Montana, W78-07357 4B
- REGUEIRO, B.**  
IBM 1130 Computation Process in the Study of Biophysical Constants Variations of Pathogenous Bacteria by Phytoplankton, W78-07264 5C
- RHO, J.**  
The Relationship of Lake Quality to Specific Urbanization Stresses, W78-07204 5C
- RIBBENS, R. W.**  
Practical Applications of Irrigation Return Flow Quality Models to Large Acreages, W78-07629 5G
- RICE, R. G.**  
European Water Treatment Practices and What We Can Learn from Them, W78-07604 5F
- Recent Advances in Ozone Technology,** W78-07444 5D
- RICHARD, J. J.**  
Analysis of Various Iowa Waters for Selected Pesticides: Atrazine, DDE, and Dieldrin--1974, W78-07331 5A
- RICHARDSON, C. J.**  
Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland, W78-07279 5C
- RICHARDSON, D.**  
The Design and Construction of the Martholme Regional Sewage-Treatment Works, W78-07477 5D
- RIDING, J. T.**  
Maximizing Phosphorus Removal in Activated Sludge, W78-07446 5D
- RIEDER, W. G.**  
Wind Powered Artificial Aeration of Northern Prairie Lakes, W78-07201 8C
- RINEHART, F. D.**  
Water Quality Model for the Upper North Platte River, W78-07206 5B
- ROACH, D. V.**  
The Role of Surface Microlayer of Water in the Distribution and Fate of Trace Organic Contaminants: A Feasibility Study, W78-07319 5B
- ROADS, J. D.**  
Effects of Clay Type and Content, Exchangeable Sodium Percentage, and Electrolyte Concentration on Clay Dispersion and Soil Hydraulic Conductivity, W78-07498 2G
- ROBERTS, J. C.**  
Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent, W78-07655 5C
- ROBERTS, M. C.**  
Variation of Drainage Density in a Small British Columbia Watershed, W78-07505 4D
- ROBERTS, P. D.**  
The Design and Construction of the Martholme Regional Sewage-Treatment Works, W78-07477 5D
- ROBERTS, P. V.**  
Phosphorus Removal by Precipitation with FE (III), W78-07465 5D
- ROBISON, J. H.**  
Availability and Quality of Ground Water in the Drain-Yoncalla Area, Douglas County, Oregon, W78-07347 7C
- ROCKWELL, G. L.**  
Description of Wells at Beale Air Force Base and Vicinity, California, W78-07358 4B
- RODDA, J. C.**  
Water Resources and Climatic Change, W78-07380 2A
- ROLSTON, D. E.**  
Field Measured Flux of Volatile Denitrification Products as Influenced by Soil Water Content and Organic Carbon Source, W78-07613 5G
- ROSMUSSEN, E. T.**  
Adsorption of Textile Dyes by Activated Carbon Produced from Agricultural, Municipal and Industrial Wastes, W78-07599 5D
- ROSSMAN, L. A.**  
Capacity Planning for Regional Wastewater Treatment Systems, W78-07521 5D
- ROUSE, H.**  
First Four Decades of the Hydraulics Division, W78-07382 2A
- ROWE, J. W.**  
Salt Loading in Disturbed Water-logged Field Study, W78-07484 5B
- ROYBAL, R. G.**  
Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico, W78-07352 8B
- RUBIN, A. J.**  
Studies on the Toxicity of Ammonia, Nitrate and their Mixtures to Guppy Fry, W78-07214 5C
- RUETER, F.**  
Evaluation of the Cost-Effectiveness of Non-structural Pollution Controls: A Manual for Water Quality Management Planning, W78-07336 5G
- RUMYANTSEV, V. B.**  
Dynamics of Lake Onega Waters, W78-07501 2H
- SABOE, T.**  
Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut, W78-07334 5A
- SAKAI, T.**  
Concentration of Acetic Acid in Sulfite Pulp Evaporation Drain by Reverse Osmosis, W78-07598 5D
- SALAS, H. J.**  
Water Quality. MESA New York Bight Atlas Monograph 27, W78-07542 5B
- SALAS, J. D.**  
Nonstationarity of the Mean and the Hurst Phenomenon, W78-07388 2E
- SALOMAN, C. H.**  
Physical, Chemical, and Biological Characteristics of Nearshore Zone of Sand Key, Florida, Prior to Beach Restoration. Vol. 1, W78-07407 2J
- SALTZBERG, E. R.**  
Implementing Cost-Effective Pollution Control by Means of Effluent Charges: An Example Applied to Electroplating Discharges, W78-07481 5G
- SAMMIS, T. W.**  
Application of Modern Irrigation Technology in the Mesilla Valley, New Mexico, W78-07634 3C
- SANBORN, E. W.**  
Evaluation of Water Quality of Puget Sound and Hood Canal in 1976, W78-07544 5C
- SANTO, J. E.**  
The Development of a Hydroperm (TM) Microfiltration System for the Treatment of Domestic Wastewater Effluents, W78-07526 5D
- SARKKA, J.**  
A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem, W78-07667 5A
- SARMA, P. B. S.**  
Urban Hydrological Modeling and Catchment Research in India, W78-07690 2A
- SAWA, T.**  
Method for Clarifying Waste Water Containing Finely Divided Oily Materials, W78-07245 5D
- SCHANKE, G. W.**  
Water/Wastewater Survey Guidelines, W78-07522 5A
- SCHILFGAARDE, J. V.**  
Minimizing Salt in Return Flow by Improving Irrigation Efficiency, W78-07616 5G
- SCHMIDT, C. J.**  
Reuse of Municipal Wastewater for Groundwater Recharge, W78-07570 5D
- SCHORNICK, J. C. JR.**  
Nitrification in Four Acidic Streams in Southern New Jersey, W78-07353 5C

# AUTHOR INDEX

SCHORNICK, J. C. JR.

- SCOTT, R. A.  
Irrigation Gravel Guard,  
W78-07235 3F
- SEABERGH, W. C.  
Improvements for Little River Inlet, South  
Carolina; Hydraulic Model Investigation,  
W78-07671 8B
- SEIP, K. L.  
A Preliminary Study of the Use of Benthic  
Algae as Biological Indicators of Heavy Metal  
Pollution in Sorfjorden, Norway,  
W78-07665 5A
- SEITZ, H. R.  
Water Resources of the Weiser River Basin,  
West-Central Idaho,  
W78-07342 4A
- SELIM, H. M.  
Simulation of Nitrogen Movement, Transfor-  
mations, and Plant Uptake in the Root Zone,  
W78-07608 5B
- SELTHUN, N. R.  
Urban Hydrological Modeling and Catchment  
Research in Norway,  
W78-07693 2A
- SEMMENS, M. J.  
Cilnophilolite Column Ammonia Removal  
Model,  
W78-07466 5D
- SEPERS, A. B. J.  
The Utilization of Dissolved Organic Com-  
pounds in Aquatic Environments,  
W78-07296 5C
- SHAFFER, M. J.  
Practical Applications of Irrigation Return  
Flow Quality Models to Large Acreages,  
W78-07629 5G
- SHAPIRO, M.  
Urban Runoff Pollution Control--State-of-the-  
Art,  
W78-07335 5G
- SHARMA, B.  
Nitrification and Nitrogen Removal,  
W78-07215 5D
- SHARMA, L. L.  
Improved Under-Water Sampler for Limnological  
Work,  
W78-07276 7B
- SHARP, D. G.  
Virion Aggregation and Disinfection of Water  
Viruses by Bromine,  
W78-07524 5F
- SHECKLEY, A. V.  
Water Resources and Climatic Change,  
W78-07380 2A
- SHELLEY, P. E.  
Sampling of Water and Wastewater,  
W78-07517 5A
- SHERENKOV, I. A.  
Computation of the Pattern of Currents in  
Rivers and Nonstratified Reservoirs,  
W78-07502 2E
- SHERRARD, J. H.  
Maximizing Phosphorus Removal in Activated  
Sludge,  
W78-07446 5D
- SHRIVER, L. E.  
Dye Waste Treatment and Reuse,  
W78-07600 5D
- SHUGAEVA, R. T.  
Calculations of the Thermal Regime of Earthen  
Dams Considering Their Construction by  
Layers,  
W78-07514 8D
- SILBERHORN, G. M.  
Delineation of Tidal Wetlands Boundaries in  
Lower Chesapeake Bay and its Tributaries,  
W78-07229 2L
- Northumberland County Tidal Marsh Invento-  
ry,  
W78-07311 2L
- York County and Town of Poquoson Tidal  
Marsh Inventory,  
W78-07310 2L
- SIMENSTAD, C. A.  
Nearshore Fish and Macroinvertebrate Assem-  
blages Along the Strait of Juan de Fuca Includ-  
ing Food Habits of Nearshore Fish,  
W78-07543 2L
- SIMMONS, C. S.  
Theoretical and Experimental Observations of  
Water and Nitrate Movement Below a Crop  
Root Zone,  
W78-07615 5B
- SIMPSON, C. L.  
Well Field Management,  
W78-07577 4B
- SINGLETON, K. G.  
Pollution Control in the Synthetic Resins Indus-  
try,  
W78-07587 5D
- SISSON, J. B.  
Effects of Irrigation Management on Soil  
Salinity and Return Flow Quality,  
W78-07619 5G
- SISSON, W. G.  
Cross-Flow Filtration in Physical-Chemical  
Treatment of Municipal Sewage Effluents,  
W78-07533 5D
- SIVALOGANATHAN, K.  
Free Surface Flow Computations by Charac-  
teristics,  
W78-07493 2E
- SKOGERBOE, G. V.  
Development of Best Management Practices  
for Salinity Control in Grand Valley,  
W78-07650 5G
- Evaluating Appropriate Technologies for  
Salinity Control in Grand Valley,  
W78-07649 5G
- The Hydro-Salinity System in the Grand Val-  
ley,  
W78-07647 5G
- An Influent Control Approach to Irrigation  
Return Flow Quality Management,  
W78-07653 5G
- Modeling Salt Transport in the Irrigated Soils  
of Grand Valley,  
W78-07648 5B
- Research and Demonstration Approach to  
Development of Appropriate Salinity Control  
Technologies for Grand Valley,  
W78-07646 5G
- SLATTERY, P. N.  
Patterns of Succession in Benthic Infaunal  
Communities Following Dredging and Dredged  
Material Disposal in Monterey Bay,  
W78-07677 5C
- SLEPTSOV, D. N.  
Temperature Regime of Low-Head Earth Dams  
in Central Yakutia,  
W78-07512 8D
- SLOSS, J. M.  
A Variational Inequality Method Applied to  
Free Surface Seepage from a Triangular Ditch,  
W78-07390 4A
- SLOTTA, L. S.  
Linear and Nonlinear Wave Action Estimates,  
W78-07485 2L
- Use of Benthic Sediments as Indicators of  
Marina Flushing,  
W78-07553 5A
- SMALL, M. M.  
Data Report--Marsh/Pond System,  
W78-07338 5D
- Natural Sewage Recycling Systems  
W78-07515 5D
- SMILES, D. E.  
Transient-And Steady-Flow Experiments Test-  
ing Theory of Water Flow in Saturated  
Bentonite,  
W78-07497 2G
- SMITH, D. G.  
New Procedure Determines Aerobic Sludge  
Stability,  
W78-07464 5D
- SMITH, J. L.  
Rate of Ammonium Nitrification and Nitrate  
Leaching in Soil Columns,  
W78-07520 5B
- SMITH, P. C.  
A Simple Model for Cross-Shelf Mixing on the  
Scottian Shelf,  
W78-07366 2L
- SMITH, S. W.  
Evaluating Appropriate Technologies for  
Salinity Control in Grand Valley,  
W78-07649 5G
- The Hydro-Salinity System in the Grand Val-  
ley,  
W78-07647 5G
- SMITH, W. G.  
National Needs for Combined Sewer Overflow  
Control,  
W78-07422 5D
- SOLYMOSY, S. L.  
Greenhouse Studies of the Growth and  
Reproduction of Egeria Densa,  
W78-07401 4A
- SPALDING, R. F.  
Nonpoint Nitrate Contamination of Ground  
Water in Merrick County, Nebraska,  
W78-07506 5B
- SPAULDING, M.  
Generation of Tidal Current and Height Charts  
for Narragansett Bay Using a Numerical  
Model,  
W78-07555 2L



# AUTHOR INDEX

TAYLOR, P. M.

- SPENCER, J.  
The '208' Planning Effort for Irrigated Agriculture in the State of Washington, W78-07642 5G  
Irrigation Return Flow Problems in Yakima Valley, W78-07640 5G  
The Sulphur Creek Pilot Project: A Practical Approach to Control of Pollutants Leaving Irrigated Farmlands, W78-07641 5G
- SPINOLA, A. A.  
Ozonation of Coal Gasification Plant Wastewater, W78-07589 5A
- SQUIRE, J. L. JR.  
Surface Currents as Determined by Drift Card Releases Over the Continental Shelf Off Central and Southern California, W78-07556 5B
- SRNA, R. F.  
Physical-Chemical Methods for the Control of Algal Species and Composition in Algal Culturing Facilities, W78-07324 5G
- STAMPFER, J. F.  
The Role of Surface Microlayer of Water in the Distribution and Fate of Trace Organic Contaminants: A Feasibility Study, W78-07319 5B
- STANBRIDGE, H. H.  
History of Sewage Pumping in Britain, W78-07417 8C
- STANLEY, J. G.  
Production of Monosex White Amur for Aquatic Plant Control, W78-07326 4A
- STARR, J. L.  
Dispersion in Soil Columns: Effect of Boundary Conditions and Irreversible Reactions, W78-07386 2G
- STAUFFER, M. L.  
Floodplain Delineation Using LANDSAT-1 Data, W78-07510 4A
- STEELE, T. D.  
Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado, W78-07356 5B
- STEFAN, H.  
Effluent Mixing Zone in a Shallow River, W78-07483 5B
- STEINBERG, C.  
Stable Nitrogen-Containing Dissolved Organic Substance in Lake Schoehsee and in Cultures of Algae (In German), W78-07260 5B
- STEINER, C. J.-P.  
Arrestment of Fumes in the Non-Ferrous Metals Industry, W78-07596 5G
- STEINFORT, S. N.  
Nearshore Fish and Macroinvertebrate Assemblages Along the Strait of Juan de Fuca Including Food Habits of Nearshore Fish, W78-07543 2L
- STEMERDING, S.  
The Recovery of Protein From Potato Juice Waste Water by Foam Separation, W78-07592 5D
- STOL'NIKOV, V. V.  
Concrete for Building Dams on a Rock Foundation as it Relates to the Problem of Crack Resistance under Severe Climatic Conditions, W78-07362 8F
- STUCKEY, D. C.  
Effect of Thermal Pretreatment on Digestibility and Dewaterability of Organic Sludges, W78-07457 5D
- STUIVER, M.  
North American Glacial History Extended to 75,000 Years Ago, W78-07372 2C
- SU, Y.-S.  
Nitrogen Transformations in Land Treatment, W78-07216 5B
- SUDO, T.  
Kinetic Studies on the Lime Sulfurated Solution (Calcium Polysulfide) Process for Removal of Heavy Metals from Waste Water, W78-07595 5D
- SUNADA, D. K.  
Artificial Ground-Water Recharge with Capillarity, W78-07365 4B
- SUNDA, W. G.  
Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes Pugio: Importance of Free Cadmium Ion, W78-07662 5C
- SUNDARAM, T. R.  
The Development of a Hydropem (TM) Microfiltration System for the Treatment of Domestic Wastewater Effluents, W78-07526 5D
- SUTTON, P. M.  
Nitrification Systems with Integrated Phosphorus Precipitation, W78-07450 5D
- SVARZ, J. J.  
Removal of Color from Paper Mill Waste Waters, W78-07238 5D
- SWANN, A. I.  
Monitoring of Waters for Bdellovibrio Bacteriovorus - A Parasite of Gram Negative Enteric Bacteria Present in Sewage, W78-07323 5A
- SWANSON, C.  
Generation of Tidal Current and Height Charts for Narragansett Bay Using a Numerical Model, W78-07555 2L
- SWARTS, F. A.  
Factors Involved in the Resistance of Brook Trout to Sulfuric Acid Solutions and Mine Acid Polluted Waters, W78-07684 5C
- SWEAZY, R. M.  
Make Wastewater More Versatile: Reuse it for Recreation Lakes, W78-07217 5D
- SWENSON, R. S.  
Wellton-Mohawk On-Farm Systems Improvement Program, W78-07645 3C
- SWOBODA, A. R.  
Nitrate Movement in Clay Soils and Methods of Pollution Control, W78-07609 5B
- SZIRMAY, L. V.  
Dye Infusion Technique Assesses Stream Pollution in Ohio, W78-07373 5B
- TABAK, H. H.  
Mississippi River Basin Sterol Assay Project Report. Coprostanol, A Positive Molecular Marker of Domestic and Run-Off Sewage, Wastewater Plant Effluent and Surface Waters in the Burlington, Iowa Area on the Mississippi River, W78-07329 5A  
Missouri River Basin Sterol Assay Project Report. Coprostanol, A Positive Marker of Domestic and Run-Off Pollution: Sterol Assay of Wastewater Plant Effluents and Surface Waters of the Lower Main Stem Missouri, W78-07328 5A
- TAI, C. H.  
Orifice Effects on Oscillatory Flow, W78-07487 8B
- TAMAI, Y.  
A Pilot Plant Study on Advanced Treatment of Treated Sewage for Re-Use, (In Japanese), W78-07445 5D
- TAMBO, N.  
Steric Hindrance on Competitive Interaction in Activated Carbon Adsorption from BI-Solute Solution of Phenol and Organics in Biological Treated Sewage, (In Japanese), W78-07455 5D
- TAN, P.  
Water Resources and Climatic Change, W78-07380 2A
- TANJI, K. K.  
An Economic Analysis of Irrigation Return Flow Recycle Systems in the Central Valley of California, W78-07625 5G  
Evaluation of Surface Irrigation Return Flows in the Central Valley of California, W78-07624 5B  
Theoretical and Experimental Observations of Water and Nitrate Movement Below a Crop Root Zone, W78-07615 5B
- TATTERSFIELD, D.  
Photorespiration in Larger Littoral Algae, W78-07274 5C
- TAUXE, G. W.  
Clinoptilolite Column Ammonia Removal Model, W78-07466 5D  
S-Hydrographs and Change of Unit Hydrograph Duration, W78-07385 2A
- TAYLOR, P. M.  
Oil Pollution Monitoring and Monitoring Unit, W78-07234 5A

# AUTHOR INDEX

TAYLOR, P. M.

- TAYLOR, T. E.**  
Landmark Texas Decision Agrees Benefit is not Worth the Cost, W78-07475 5G
- TEBBUTT, T. H. Y.**  
Developments in Performance Relationships for Sewage, W78-07467 5D
- TEILING, E.**  
Eulimnion, an Original Place of New Forms, W78-07285 5C  
  
Evolutionary Studies on the Shape of the Cell and of the Chloroplast in Desmids, W78-07283 2I  
  
Morphological Investigations of Asymmetry in Desmids, W78-07284 2I
- TESSAR, P. A.**  
The South Dakota Cooperative Land use Effort: A State Level Remote Sensing Demonstration Project, W78-07315 4A
- THOMANN, R. V.**  
Water Quality. MESA New York Bight Atlas Monograph 27, W78-07542 5B
- THUOTTE, R. M.**  
Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes Pugio: Importance of Free Cadmium Ion, W78-07662 5C
- TKHOMIROV, V. N.**  
Role of Plankton in the Behavior of TC99 and MN54 in Seawater, W78-07286 5C
- TODD, W. J.**  
The South Dakota Cooperative Land use Effort: A State Level Remote Sensing Demonstration Project, W78-07315 4A
- TOLSTOPYATOVA, G. V.**  
Hygienic Evaluation of Effectiveness of Urban Sewage Purification in Oxidation Ponds (In Russian), W78-07270 5D
- TOMSON, M. B.**  
pH Averaging, W78-07456 5A
- TONKYN, R. G.**  
Process for Clarification of Oil-Containing Waste, W78-07248 5D
- TOY, D. W.**  
Field Measured Flux of Volatile Denitrification Products as Influenced by Soil Water Content and Organic Carbon Source, W78-07613 5G
- TRZILOVA, B.**  
Microbiological Aspects of Pollution and Self-Purification of the Water of the River Danube on its Czechoslovak Section (In German), W78-07267 5C  
  
Preliminary Tests of the Influence of Waste Waters from Sugar Factories on the Numbers of Intestinal Bacteria in Water (In German), W78-07223 5C
- TUNG, Y.-K.**  
State Variable Model for Sewer Network Flow Routing, W78-07212 8B
- TURNER, F. C.**  
Quality of Irrigation Return Flow from Flooded Rice Paddies, W78-07623 5B
- TYAGI, D. M.**  
Drag on Baffle Walls in Hydraulic Jump, W78-07491 8B
- UTKILEN, H. C.**  
Characterization of Sulphate Uptake in Anaerobes, W78-07304 5C
- VAN DEN BROEK, W. L. F.**  
Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W78-07661 5C
- VAN WINKLE, W.**  
COPEPOD4: A Discrete Time-Delay Model of Copepod Population Dynamics, W78-07289 5B
- VASIL'YEV, A. B.**  
Investigation of Snow Control Systems on an Avalanche Slope, W78-07375 4A
- VIATOR, D. P.**  
Greenhouse Studies of the Growth and Reproduction of Egeria Densa, W78-07401 4A
- VICK, H. C.**  
West Point Lake Postimpoundment Study, W78-07287 5C
- VIDILLES, J.**  
Concentrators for Recovering Liquid Pollutant Floating on the Surface of a Sheet of Water, W78-07233 5G
- VIRARAGHAVAN, T.**  
Travel of Microorganisms from a Septic Tile, W78-07469 5B
- VLACHOS, E.**  
A Process for Identifying, Evaluating and Implementing Solutions for Irrigation Return Flow Problems, W78-07654 5G
- VODRASKA, K. F.**  
Identification of Alternative Power Sources for Dredged Material Processing Operations, W78-07680 8C
- VOINOVA, S.**  
Mercury Pollution of Water (In Bulgarian), W78-07268 5B
- VORCHHEIMER, N.**  
Process for Clarification of Oil-Containing Waste, W78-07248 5D
- WALKER, W. R.**  
Combining Agricultural Improvements and Desalting of Return Flows to Optimize Local Salinity Control Policies, W78-07628 5G  
  
Development of Best Management Practices for Salinity Control in Grand Valley, W78-07650 5G
- Evaluating Appropriate Technologies for Salinity Control in Grand Valley, W78-07649 5G**
- The Hydro-Salinity System in the Grand Valley, W78-07647 5G**
- Modeling the Irrigation Return Flow System-Current Capabilities and Future Needs, W78-07633 5G**
- Research and Demonstration Approach to Development of Appropriate Salinity Control Technologies for Grand Valley, W78-07646 5G**
- WALLIS, C.**  
Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater, W78-07463 5F  
  
Viruses in Water: The Increasing Urgency of the Problem and Approaches to its Solution (In Russian), W78-07261 5G
- WANSTRATH, J. J.**  
Nearshore Numerical Storm Surge and Tidal Simulation, W78-07679 8B
- WARD, A.**  
Effluent Treatment Plant for the Smaller Community, W78-07428 5D
- WARREN, E.**  
Temperature Requirements of Salmonids in Relation to Their Feeding, Bioenergetics, Growth and Behavior, W78-07322 5C
- WARRICK, A. W.**  
Areal Predictions of Soil Water Flux in the Unsaturated Zone, W78-07630 2C
- WAYENBERG, J. A.**  
Visual Observations of Floating Ice from Skylab, W78-07346 2C
- WEBB, J. W.**  
Shoreline Plant Establishment and Use of a Wave-Stilling Device, W78-07230 2I
- WEBER, T.**  
Phosphorus Removal by Precipitation with Fe (III), W78-07465 5D
- WEBSTER, J.**  
Taxonomic Studies on Aquatic Hyphomycetes, I. Lemmonia de Wildeman, W78-07271 5A
- WEEKS, W. F.**  
Visual Observations of Floating Ice from Skylab, W78-07346 2C
- WEIENBERG, D. C.**  
The Recovery of Protein From Potato Juice Waste Water by Foam Separation, W78-07592 5D
- WELLS, D. M.**  
Make Wastewater More Versatile: Reuse it for Recreation Lakes, W78-07217 5D

# AUTHOR INDEX

ZUIDEMA, F. C.

- WENDT, C. W.**  
Effect of Irrigation Systems on Water Use Efficiency and Soil Water Solute Concentrations, W78-07620 5G
- Effect of Three Irrigation Systems on Distribution of Fertilizer Nitrate Nitrogen in Soil, W78-07610 5B
- WENTZ, W. A.**  
Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland, W78-07279 5C
- WERNER, D.**  
Self Cleaning, Pressure Responsive Emitter Valve for Soil Irrigation, W78-07243 3F
- WESTERGAARD, J. M.**  
Monitoring of Waters for *Bdellovibrio Bacteriovorus* - A Parasite of Gram Negative Enteric Bacteria Present in Sewage, W78-07323 5A
- WESTLUND, C. W.**  
Formulating State Groundwater Policy in Pennsylvania, W78-07576 5G
- WHARFE, J. R.**  
Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W78-07661 5C
- WHEELER, C. L.**  
An Engineering Report on Selected Reservoir Sites in the Bandon Area, W78-07280 6B
- WHITE, R. R.**  
Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico, W78-07352 8B
- WIERENGA, P. J.**  
Effects of Irrigation Management on Soil Salinity and Return Flow Quality, W78-07619 5G
- Solute Transport Through Soil with Nonuniform Water Content, W78-07496 2G
- WILKE, O. C.**  
Effect of Irrigation Systems on Water Use Efficiency and Soil Water Solute Concentrations, W78-07620 5G
- Effect of Three Irrigation Systems on Distribution of Fertilizer Nitrate Nitrogen in Soil, W78-07610 5B
- WILLARDSON, L. S.**  
Field Evaluation of Sprinkler Irrigation for Management of Irrigation Return Flow, W78-07618 5G
- Modeling Salinity of Irrigation Return Flow Where Sources and Sinks are Present, W78-07617 5B
- WILLIAMS, N. J.**  
The Relation Between Adenosine Triphosphate and Microbial Biomass in Diverse Aquatic Ecosystems, W78-07306 5C
- WILSON, C. A.**  
Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico, W78-07352 8B
- WILSON, D. D.**  
Hydrogeology of Metropolitan Christchurch, W78-07368 4B
- WILSON, J. L.**  
Two-Dimensional Plume in Uniform Ground-Water Flow, W78-07490 5B
- WITMER, R. E.**  
The National Land Use Data Program of the U.S. Geological Survey, W78-07316 4A
- WOELKE, C. E.**  
Evaluation of Water Quality of Puget Sound and Hood Canal in 1976, W78-07544 5C
- WOESSNER, J. W.**  
An In Situ Study of Recruitment, Growth and Survival of Subtidal Marine Algae: Techniques and Preliminary Results, W78-07308 5C
- WOLVERTON, B. C.**  
Water Hyacinths and Alligator Weeds for Final Filtration of Sewage, W78-07299 5D
- WOOD, J. D.**  
Hydro-Salinity Models: Sensitivity to Input Variables, W78-07632 5B
- WU, A. C. M.**  
Effect of Time of Deacetylation on Molecular Weight Distribution, Acetyl Content, Viscosity, and Performance of Chitsan as a Conditioning Agent for Activated Sludge, W78-07552 5D
- YAHIKOZAWA, K.**  
Kinetic Studies on the Lime Sulfurated Solution (Calcium Polysulfide) Process for Removal of Heavy Metals from Waste Water, W78-07595 5D
- YAMADA, T.**  
A Pilot Plant Study on Advanced Treatment of Treated Sewage for Re-Use, (In Japanese), W78-07445 5D
- YANG, I. C.**  
North American Glacial History Extended to 75,000 Years Ago, W78-07372 2C
- YANO, T.**  
Kinetic Studies on the Lime Sulfurated Solution (Calcium Polysulfide) Process for Removal of Heavy Metals from Waste Water, W78-07595 5D
- YEO, R. R.**  
Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, W78-07399 5G
- Aquatic Weed Control in Small Reservoirs with Diquat, W78-07402 5G
- YOKOTA, K.**  
Concentration of Acetic Acid in Sulfite Pulp Evaporation Drain by Reverse Osmosis, W78-07598 5D
- YOUNG, H. F.**  
Rotating Disc Sewage Treatment Systems for Suburban Developments and High-Density Resorts of Hawaii, W78-07393 5D
- YOUNG, H. W.**  
Water Resources of the Weiser River Basin, West-Central Idaho, W78-07342 4A
- YOUNG, R. A.**  
Suspended-Matter Distribution in the New York Bight Apex Related to Hurricane Belle, W78-07509 2L
- YU, Y. S.**  
Orifice Effects on Oscillatory Flow, W78-07487 8B
- ZADERA, K. V.**  
Treatment of Water to Remove Certain Ions Therefrom, W78-07246 5F
- ZALIZNYAK, YE. L.**  
Analysis of Intense Precipitation in the Krasnoyarsk Area, W78-07374 2B
- ZAPATKA, M. C.**  
Technical and Philosophical Aspects of Ocean Disposal, W78-07540 5E
- ZARADNY, H.**  
Boundary Conditions in Modeling Water Flow in Unsaturated Soils, W78-07503 2G
- ZAVESKY, R. R.**  
Prediction of Temperature Due to Heated Discharges, W78-07495 5B
- ZETRIDES, T. C.**  
Mutant Bacteria Solve BOD Problem at Heat Packing Plant, W78-07603 5D
- ZHDANOVA, I. S.**  
Investigation of Level Fluctuations in Closed Bodies of Water on the Basis of Stochastic Models of the Elements of the Hydrologic Budget, W78-07500 2E
- ZUIDEMA, F. C.**  
Urban Hydrological Modeling and Catchment Research in the Netherlands, W78-07692 2A
- Urban Hydrological Modeling and Catchment Research: International Summary, W78-07689 2A

ACADEMY  
(BULGARIA)  
OCCUPATION  
OF MEDICINE  
NUTRITION  
Mercury E  
W78-0726

ADI LTD., E  
Travel of  
W78-0746

AGRICULT  
DAVIS, CA.  
Aquatic W  
Diquat,  
W78-0740

AGRICULT  
LAUDERDA  
Efficacy  
Control of  
W78-0740

AGRICULT  
KIMBERLY  
CONSERVA  
Scientific  
Control of  
W78-0762

AGRICULT  
RIVERSIDE  
Effects of  
ble Sodium  
centration  
lic Condu  
W78-0749

Multiple T  
W78-0749

Minimizin  
Irrigation  
W78-0761

AGRICULT  
RIVERSIDE  
Hydro-Sa  
Variables.  
W78-0763

AKADEMIY  
HIDROBIO  
Role of H  
mulation  
in Inland  
W78-0729

ALEXANDR  
FISHERIES  
The Prob  
Qarun (Eg  
W78-0730

ALLAHABA  
A Simple  
Relative E  
W78-0750

AMERICAN  
NEW YORK  
Urban Hy  
Research:  
W78-0768

Urban Hy  
Research  
W78-0770



# ORGANIZATIONAL INDEX

- ACADEMY OF MEDICINE, SOFIA (BULGARIA). INST. OF HYGIENE AND OCCUPATIONAL DISEASES; AND ACADEMY OF MEDICINE, SOFIA (BULGARIA). INST. OF NUTRITION.**  
Mercury Pollution of Water (In Bulgarian), W78-07268 5B
- ADI LTD., FREDERICKSON (NEW ENGLAND).**  
Travel of Microorganisms from a Septic Tile, W78-07469 5B
- AGRICULTURAL RESEARCH SERVICE, DAVIS, CA.**  
Aquatic Weed Control in Small Reservoirs with Diquat, W78-07402 5G
- AGRICULTURAL RESEARCH SERVICE, FORT LAUDERDALE, FL. SOUTHERN REGION.**  
Efficacy and Residues of Diquat Applied for Control of Egeria and Hydrilla, W78-07400 5G
- AGRICULTURAL RESEARCH SERVICE, KIMBERLY ID. SNAKE RIVER CONSERVATION RESEARCH CENTER.**  
Scientific Irrigation Scheduling for Salinity Control of Irrigation Return Flow, W78-07621 5G
- AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, CA. SALINITY LAB.**  
Effects of Clay Type and Content, Exchangeable Sodium Percentage, and Electrolyte Concentration on Clay Dispersion and Soil Hydraulic Conductivity, W78-07498 2G  
Multiple Tensiometer Flushing System, W78-07499 2G  
Minimizing Salt in Return Flow by Improving Irrigation Efficiency, W78-07616 5G
- AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, SALINITY LAB.**  
Hydro-Salinity Models: Sensitivity to Input Variables, W78-07632 5B
- AKADEMIYA NAUK URSR, KIEV. INST. HYDROBIOLOGII.**  
Role of Higher Aquatic Vegetation in the Accumulation of Organic and Biogenic Substances in Inland Waters, W78-07294 5C
- ALEXANDRIA INST. OF OCEANOGRAPHY FISHERIES (EGYPT).**  
The Problem of the Salinity Increase in Lake Qarun (Egypt) and a Proposed Solution, W78-07305 5C
- ALLAHABAD UNIV. (INDIA).**  
A Simple Laboratory Apparatus to Measure Relative Erodibility of Soils, W78-07504 2J
- AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK.**  
Urban Hydrological Modeling and Catchment Research: International Summary, W78-07689 2A  
Urban Hydrological Modeling and Catchment Research in the U.S.A., W78-07700 2A
- ARIZONA UNIV., TUCSON. DEPT. OF SOILS, WATER AND ENGINEERING.**  
Areal Predictions of Soil Water Flux in the Unsaturated Zone, W78-07630 2G
- ARKANSAS STATE UNIV., UNIVERSITY. DEPT. OF PHYSICAL SCIENCES.**  
Radionuclide Concentrations in the Arkansas River Upstream and Downstream from the Nuclear I Power Generating Facility, W78-07320 5B
- ARMY ENGINEER DISTRICT, NORFOLK, VA.**  
Final Environmental Statement for Walker Dam Impoundment, Aquatic Plant Control Project, New Kent County, Virginia, W78-07403 6G
- ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS.**  
Aquatic Use Pattern for Diquat for Control of Egeria and Hydrilla, W78-07399 5G  
Model Study of Cool Water Discharge from Proposed LNG Facility, Los Angeles Harbor, California, W78-07669 5B  
Dispersion of Proposed Effluent Discharges and Saltwater Intrusion in Cooper River; Hydraulic Model Investigation, W78-07670 5B  
Improvements for Little River Inlet, South Carolina; Hydraulic Model Investigation, W78-07671 8B  
Physical Hydraulic Models: Assessment of Predictive Capabilities; Report 2, Movable-Bed Model of Galveston Harbor Entrance, W78-07672 8B  
Containment Area Management to Promote Natural Dewatering of Fine-Grained Dredged Material, W78-07673 5E  
Positioning Techniques and Equipment for U. S. Army Corps of Engineers Hydrographic Surveys, W78-07676 7B  
Investigation of Remote Water-Quality Monitoring Systems for Use With GOES or ERTS Water Data Transmitter, W78-07678 5A  
Nearshore Numerical Storm Surge and Tidal Simulation, W78-07679 8B
- ATOMIC ENERGY COMMISSION, AMES, IA.**  
Analysis of Various Iowa Waters for Selected Pesticides: Atrazine, DDE, and Dieldrin--1974, W78-07331 5A
- ATOMIC ENERGY OF CANADA LTD., CHALK RIVER (ONTARIO). CHALK RIVER NUCLEAR LABS.**  
Hydrological Studies on a Small Basin on the Canadian Shield, W78-07406 2H
- AUBURN UNIV., AL. DEPT. OF AGRICULTURAL ENGINEERING.**  
Performance of a Trickling Filter, Solids Removal, and Anaerobic Digestion System for Recycled Poultry Manure Wastewater, W78-07207 5D
- AUBURN UNIV., AL. DEPT. OF MECHANICAL ENGINEERING.**  
The Effects of Diurnal Mixing on Thermal Stratification of Static Impoundments, W78-07210 2H
- AUBURN UNIV., AL. DEPT. OF MICROBIOLOGY.**  
Monitoring of Waters for Bdellovibrio Bacteriovorus - A Parasite of Gram Negative Enteric Bacteria Present in Sewage, W78-07323 5A
- BADISCHE ANILIN-UND SODA-FABRIK A.G., LUDWIGSHAFEN AM. RHEIN (WEST GERMANY).**  
Determination of Total Organic Carbon in Potable Water, Sewage, Industrial Effluents, and Boiler Feed Water, W78-07404 5A
- BAILEY METERS AND CONTROLS LTD. (ENGLAND). (ASSIGNEE).**  
Oil Pollution Monitoring and Monitoring Unit, W78-07234 5A
- BALLAST NEDAM GROEP N.V., AMSTELVEEN (NETHERLANDS). (ASSIGNEE).**  
Device for Collecting Light-Weight Substances Floating on a Liquid Surface, W78-07253 5G
- BATTELLE PACIFIC NORTHWEST LAB., RICHLAND, WA.**  
A Generalized Water Quality Model for Eutrophic Lakes and Reservoirs, W78-07290 5C
- BAYERISCHE FUER LANDESAMT WASSERWIRTSCHAFT, MUNICH (WEST GERMANY).**  
Stable Nitrogen-Containing Dissolved Organic Substance in Lake Schochsee and in Cultures of Algae (In German), W78-07260 5B
- BAYLOR COLL. OF MEDICINE, HOUSTON, TX. DEPT. OF VIROLOGY AND EPIDEMIOLOGY.**  
Concentration of Enteroviruses from Large Volumes of Tap Water, Treated Sewage, and Seawater, W78-07463 5F
- BERGEN UNIV. (NORWAY). BOTANICAL LAB.; AND BERGEN UNIV. (NORWAY). INST. FOR GENERAL MICROBIOLOGY.**  
Characterization of Sulphate Uptake in Anacystis Nidulans, W78-07304 5C
- BETZ LAB., INC., TREVOSE, PA. (ASSIGNEE).**  
Process for Clarification of Oil-Containing Waste, W78-07248 5D
- BIGELOW LAB. FOR OCEAN SCIENCES, WEST BOOTHBAY HARBOR, ME.**  
Photorepiration in Marine Phytoplankton, W78-07309 5C
- BIRMINGHAM UNIV., (ENGLAND). DEPT. OF CIVIL ENGINEERING.**  
Developments in Performance Relationships for Sewage, W78-07467 5D
- BLACK AND VEATCH, DETROIT, MI.**  
Conserve Energy in Wastewater Systems, W78-07476 5D

# ORGANIZATIONAL INDEX

## BLACK AND VEATCH, DETROIT, MI.

**BOLLMAN (GEORGE W.) AND CO., INC.,**  
**ADAMSTOWN, PA. (ASSIGNEE).**  
 Process for Treating Wool Scouring Wastes,  
 W78-07249 5D

**BONNEVILLE POWER ADMINISTRATION,**  
**PORTLAND, OR.**  
 The Dishonest Method in Stream Temperature  
 Modeling,  
 W78-07392 2D

**BROOKHAVEN NATION LAB., UPTON, NY.**  
**DEPT. OF APPLIED SCIENCE.**  
 Natural Sewage Recycling Systems  
 W78-07515 5D

**BROOKHAVEN NATIONAL LAB., UPTON, NY.**  
**DEPT. OF APPLIED SCIENCE.**  
 Data Report--Marsh/Pond System,  
 W78-07338 5D

**BROWNSVILLE PUBLIC UTILITIES BOARD,**  
**TX.**  
 Wastewater Effluent Line Serves Dual Pur-  
 pose,  
 W78-07419 5E

**BUREAU OF RECLAMATION, DENVER, CO.**  
**ENGINEERING AND RESEARCH CENTER.**  
 Practical Applications of Irrigation Return  
 Flow Quality Models to Large Acreages,  
 W78-07629 5G

**BUREAU OF RECLAMATION, SACRAMENTO,**  
**CA. MID-PACIFIC REGIONAL OFFICE.**  
 Agricultural Drainage Problems of the San  
 Joaquin Valley,  
 W78-07636 4A

**BUREAU OF RECLAMATION, YUMA, AZ.**  
**YUMA PROJECTS OFFICE.**  
 An Assessment of Irrigation Efficiencies and  
 Drainage Return Flows from the Wellton-  
 Mohawk Division of the Gila Project,  
 W78-07644 3C

**CALIFORNIA INST. OF TECH., PASADENA. W.**  
**M. KECK LAB. OF ENVIRONMENTAL**  
**SCIENCE.**  
 Trace Metal-Chelator Interactions and  
 Phytoplankton Growth in Seawater Media:  
 Theoretical Analysis and Comparison with Re-  
 ported Observations,  
 W78-07663 5C

**CALIFORNIA UNIV., BERKELEY. LAWRENCE**  
**BERKELEY LAB.; AND CALIFORNIA UNIV.,**  
**BERKELEY. DIV. OF ENERGY AND**  
**ENVIRONMENT.**  
 Energy and Water,  
 W78-07508 6D

**CALIFORNIA UNIV., BERKELEY. SANITARY**  
**ENGINEERING RESEARCH LAB.**  
 Nuisance-Algae Control Through Mechanical  
 Harvesting,  
 W78-07266 5G

**CALIFORNIA UNIV., DAVIS. DEPT. OF**  
**AGRICULTURAL ECONOMICS.**  
 An Economic Analysis of Irrigation Return  
 Flow Recycle Systems in the Central Valley of  
 California,  
 W78-07625 5G

**CALIFORNIA UNIV., DAVIS. DEPT. OF CIVIL**  
**ENGINEERING.**  
 Economic Impact of Water Quality on River  
 Basin Management,  
 W78-07396 5G

**CALIFORNIA UNIV., DAVIS. DEPT. OF LAND,**  
**AIR AND WATER RESOURCES.**  
 Field Measured Flux of Volatile Denitrification  
 Products as Influenced by Soil Water Content  
 and Organic Carbon Source,  
 W78-07613 5G

Soil Nitrate Concentrations in Corn Plots  
 Treated with Isotopically Labeled Nitrogen  
 Fertilizer,  
 W78-07614 5B

Theoretical and Experimental Observations of  
 Water and Nitrate Movement Below a Crop  
 Root Zone,  
 W78-07615 5B

Evaluation of Surface Irrigation Return Flows  
 in the Central Valley of California,  
 W78-07624 5B

**CALIFORNIA UNIV., DAVIS. DEPT. OF SOIL**  
**AND CROP SCIENCES.**  
 Quality of Irrigation Return Flow from Flooded  
 Rice Paddies,  
 W78-07623 5B

**CALIFORNIA UNIV., DAVIS. DIV. OF**  
**ENVIRONMENTAL STUDIES.**  
 The Relation Between Adenosine Triphosphate  
 and Microbial Biomass in Diverse Aquatic  
 Ecosystems,  
 W78-07306 5C

**CALIFORNIA UNIV. IRVINE. DEPT. OF**  
**POPULATION AND ENVIRONMENTAL**  
**BIOLOGY.**  
 Ecological Components Structuring the  
 Seaward Edges of Tropical Pacific Reefs: The  
 Distribution, Communities and Productivity of  
 Porolithon,  
 W78-07327 2L

**CALIFORNIA UNIV., RIVERSIDE.**  
 Variability of Nitrate Leaching Within Defined  
 Management Units,  
 W78-07612 5B

**CALIFORNIA UNIV., SANTA BARBARA. DEPT.**  
**OF BIOLOGICAL SCIENCES; AND**  
**CALIFORNIA UNIV., SANTA BARBARA.**  
**MARINE SCIENCE INST.**

An In Situ Study of Recruitment, Growth and  
 Survival of Subtidal Marine Algae: Techniques  
 and Preliminary Results,  
 W78-07308 5C

**CALIFORNIA UNIV., SANTA BARBARA. DEPT.**  
**OF MECHANICAL AND ENVIRONMENTAL**  
**ENGINEERING.**  
 A Variational Inequality Method Applied to  
 Free Surface Seepage from a Triangular Ditch,  
 W78-07390 4A

**CANADA CENTRE FOR INLAND WATERS,**  
**BURLINGTON (ONTARIO).**  
 A Study of Different Analytical Extraction  
 Methods for Nondetrimental Heavy Metals in  
 Aquatic Sediments,  
 W78-07278 5A

**CANADA CENTRE FOR INLAND WATERS,**  
**BURLINGTON (ONTARIO).**  
 Measuring Petroleum Hydrocarbons in  
 Digested Sewage Sludges,  
 W78-07462 5A

**CAULFIELD INST. OF TECH. VICTORIA**  
**(AUSTRALIA). WATER STUDIES CENTRE.**  
 A New Dialysis-Ion Exchange Technique for  
 Determining the Forms of Trace Metals in  
 Water,  
 W78-07277 5A

**CENTRAL INST. FOR INDUSTRIAL**  
**RESEARCH OSLO (NORWAY).**  
 A Preliminary Study of the Use of Benthic  
 Algae as Biological Indicators of Heavy Metal  
 Pollution in Sorfjorden, Norway,  
 W78-07665 5A

**CENTRAL VALLEY REGIONAL WATER**  
**QUALITY CONTROL BOARD, SACRAMENTO,**  
**CA.**  
 How the NPDES Program Will Define Present  
 Water Quality Conditions,  
 W78-07637 5G

**CERTAIN-TEED CORP., VALLEY FORGE, PA.**  
**PIPE AND PLASTICS GROUP.**  
 PVC Pipe Passes Performance and Cost Tests,  
 W78-07479 8G

**CHEMICAL SEPARATIONS CORP., OAK**  
**RIDGE, TN. (ASSIGNEE).**  
 Removal of Chromium, Chromate, Molybdate  
 and Zinc,  
 W78-07231 5D

**CIBA-GEIGY LTD., DUXFORD (ENGLAND).**  
**ENVIRONMENTAL TECHNICAL SERVICES.**  
 Pollution Control in the Synthetic Resins Indus-  
 try,  
 W78-07587 5D

**CIVIL ENGINEERING LAB. (NAVY), PORT**  
**HUENEME, CA.**  
 Identification of Alternative Power Sources for  
 Dredged Material Processing Operations,  
 W78-07680 8C

**CLYDE AND MECHAM, SALT LAKE CITY,**  
**UT.**  
 Administrative Practice and Procedure Under  
 Permit Systems,  
 W78-07411 6E

General Adjudication Proceedings,  
 W78-07412 6E  
 Practical Aspects of Water Litigation,  
 W78-07413 6E

**COAST GUARD RESEARCH AND**  
**DEVELOPMENT CENTER, CROTON,**  
**CONNECTICUT.**  
 Rationing Methods Applied to Gas Chromato-  
 graphic Data for Oil Identification,  
 W78-07269 5A

**COLD REGIONS RESEARCH AND**  
**ENGINEERING LAB., HANOVER, NH.**  
 Land Use and Pollution Patterns on the Great  
 Lakes,  
 W78-07288 5B

Theory and Numerical Analysis of Moving  
 Boundary Problems in the Hydrodynamics of  
 Porous Media,  
 W78-07389 2F  
 Reclamation of Wastewater by Application on  
 Land,  
 W78-07519 5D

**COLORADO RIVER BOARD OF CALIFORNIA,**  
**LOS ANGELES.**  
 The 1973 Agreement on Colorado River Salini-  
 ty Between the United States and Mexico,  
 W78-07643 6E

# ORGANIZATIONAL INDEX

EDINBURGH UNIV. (SCOTLAND). DEPT. OF CIVIL ENGINEERING.

|   |    |   |    |   |    |
|---|----|---|----|---|----|
| COLORADO STATE UNIV., FORT COLLINS.<br>Proceedings of National Conference: Irrigation<br>Return Flow Quality Management.<br>W78-07606   | 5G | COMMONWEALTH SCIENTIFIC AND<br>INDUSTRIAL RESEARCH ORGANIZATION,<br>CANBERRA CITY (AUSTRALIA). DIV. OF<br>ENVIRONMENTAL MECHANICS.<br>Transient-And Steady-Flow Experiments Test-<br>ing Theory of Water Flow in Saturated<br>Bentonite.<br>W78-07497 | 2G | DELAWARE UNIV., NEWARK. COLL. OF<br>MARINE STUDIES; DELAWARE UNIV.,<br>LEWES. MARINE STUDIES COMPLEX.<br>Physical-Chemical Methods for the Control of<br>Algal Species and Composition in Algal Cultur-<br>ing Facilities.<br>W78-07324   | 5G |
| COLORADO STATE UNIV., FORT COLLINS.<br>DEPT. OF AGRICULTURAL AND CHEMICAL<br>ENGINEERING.<br>Combining Agricultural Improvements and<br>Desalting of Return Flows to Optimize Local<br>Salinity Control Policies,<br>W78-07628  | 5G | CONNECTICUT AGRICULTURAL<br>EXPERIMENT STATION, NEW HAVEN.<br>Dispersion in Soil Columns: Effect of Bounda-<br>ry Conditions and Irreversible Reactions,<br>W78-07386   | 2G | DELTA INST. FOR HYDROBIOLOGICAL<br>RESEARCH, YERSEKE (NETHERLANDS).<br>The Utilization of Dissolved Organic Com-<br>pounds in Aquatic Environments,<br>W78-07296  | 5C |
| Water Distribution Patterns for Sprinkler and<br>Surface Irrigation Systems,<br>W78-07631   | 3F | CONSAD RESEARCH CORP., PITTSBURGH,<br>PA.<br>Evaluation of the Cost-Effectiveness of Non-<br>structural Pollution Controls: A Manual for<br>Water Quality Management Planning,<br>W78-07336   | 5G | DEPARTMENT OF THE ENVIRONMENT,<br>READING (ENGLAND). WATER DATA UNIT.<br>Water Resources and Climatic Change,<br>W78-07380  | 2A |
| Modeling the Irrigation Return Flow System--<br>Current Capabilities and Future Needs,<br>W78-07633   | 5G | CONSTRUCTION ENGINEERING RESEARCH<br>LAB. (ARMY), CHAMPAIGN, IL.<br>Water/Wastewater Survey Guidelines,<br>W78-07522  | 5A | DEPARTMENT OF THE ENVIRONMENT,<br>VICTORIA BRITISH (COLUMBIA). FROZEN<br>SEA RESEARCH GROUP.<br>Salinity: Its Definition and Calculation,<br>W78-07367  | 2K |
| Research and Demonstration Approach to<br>Development of Appropriate Salinity Control<br>Technologies for Grand Valley,<br>W78-07646  | 5G | COOPER UNION, (NY) NY. DEPT. OF CIVIL<br>ENGINEERING.<br>Prediction of Temperature Due to Heated<br>Discharges,<br>W78-07495  | 5B | DEPARTMENT OF WASTE WATER<br>TECHNOLOGY AND SLUDGE DISPOSAL,<br>WARSAW (POLAND). LOCAL ECONOMY AND<br>ENVIRONMENT PROTECTION.<br>The Research Works on Sewage Treatment in<br>Poland,<br>W78-07531  | 5D |
| The Hydro-Salinity System in the Grand Val-<br>ley,<br>W78-07647  | 5G | CORNING GLASS WORKS, NY.<br>Nitrification and Nitrogen Removal,<br>W78-07215  | 5D | DEVELOPMENT AND RESOURCES<br>TRANSPORTATION CO., SILVER SPRING,<br>MD.<br>Appendix E to Correlation of Dual-Channel<br>Airborne IR Data with Soil Moisture Measure-<br>ments,<br>W78-07383  | 2G |
| Evaluating Appropriate Technologies for<br>Salinity Control in Grand Valley,<br>W78-07649   | 5G | COUNCIL FOR SCIENTIFIC AND INDUSTRIAL<br>RESEARCH, PRETORIA (SOUTH AFRICA).<br>NATIONAL PHYSICAL RESEARCH LAB.<br>Variability of Hailstorms on the South African<br>Plateau,<br>W78-07507   | 2B | DIDIER (J. M.) AND ASSOCIATES, BRUSSELS<br>(BELGIUM).<br>Treatment and Use of Sewage Purification<br>Plant Sludges,<br>W78-07425  | 5D |
| Development of Best Management Practices<br>for Salinity Control in Grand Valley,<br>W78-07650  | 5G | CULTURAL RESEARCH SERVICE,<br>KIMBERLY ID. SNAKE RIVER<br>CONSERVATION RESEARCH CENTER.<br>Management Guidelines for Controlling Sedi-<br>ments, Nutrients, and Adsorbed Biocides in Ir-<br>rigation Return Flows,<br>W78-07622                       | 5G | DNEPROPETROVSKII KHIMIKO-<br>TEKHONOLICHESKII INST. (USSR).<br>The Effect of the Ionic Composition of the En-<br>vironment on Oxygen Exchange in the Alga<br>Acetabularia (In Russian),<br>W78-07213  | 5C |
| COLORADO STATE UNIV., FORT COLLINS.<br>DEPT. OF AGRICULTURAL ENGINEERING.<br>Rate of Ammonium Nitrification and Nitrate<br>Leaching in Soil Columns,<br>W78-07520   | 5B | DALHOUSIE UNIV., HALIFAX. (NOVA<br>SCOTIA) DEPT. OF OCEANOGRAPHY.<br>A Simple Model for Cross-Shelf Mixing on the<br>Scotian Shelf,<br>W78-07366  | 2L | DURBAN CITY ENGINEERS DEPT. (SOUTH<br>AFRICA).<br>Future Treatment Plant Requirements,<br>W78-07474   | 5D |
| COLORADO STATE UNIV., FORT COLLINS.<br>DEPT. OF CIVIL ENGINEERING.<br>Artificial Ground-Water Recharge with Capil-<br>larity,<br>W78-07365  | 4B | DALLAS WATER UTILITIES DEPT., TX.<br>Landmark Texas Decision Agrees Benefit is<br>not Worth the Cost,<br>W78-07475  | 5G | EASTMAN CHEMICAL PRODUCTS, INC.,<br>KINGSPORT TN. PHOTOGRAPHIC<br>TECHNOLOGY DIV.<br>Photographic Processing Effluent Control,<br>W78-07588   | 5D |
| COLORADO STATE UNIV., FORT COLLINS.<br>DEPT. OF ECONOMICS.<br>Interface of Water Quantity and Quality Laws<br>in the West,<br>W78-07652   | 6E | DALLAS WATER UTILITIES DEPT., TX.<br>OPERATIONS ANALYSIS DIV.<br>Dallas Urban Runoff, Storm of February 11,<br>1977.<br>W78-07361   | 2B | ECONOMICS, STATISTICS, AND<br>COOPERATIVE SERVICE, WASHINGTON, DC.<br>NATURAL RESOURCE ECONOMICS DIV.<br>Effect of the Small Watershed Program on<br>Major Uses of Land: Examination of 60 Pro-<br>jects in the Southeast, Mississippi Delta, and<br>Missouri River Tributaries Regions,<br>W78-07330 | 4D |
| An Influent Control Approach to Irrigation<br>Return Flow Quality Management,<br>W78-07653  | 5G | DANISH SOIL CONSERVATION SERVICE,<br>VIBORG. RESEARCH DEPT.<br>Nitrogen Transformation in Lakes,<br>W78-07262   | 5C | EDINBURGH UNIV. (SCOTLAND). DEPT. OF<br>CIVIL ENGINEERING.<br>Model Tests of Circular Sewage Sedimentation<br>Tanks,<br>W78-07468   | 5D |
| COLORADO STATE UNIV., FORT COLLINS.<br>DEPT. OF SOCIOLOGY.<br>A Process for Identifying, Evaluating and Im-<br>plementing Solutions for Irrigation Return Flow<br>Problems,<br>W78-07654  | 5G | DELAWARE UNIV., NEWARK. COLL. OF<br>MARINE STUDIES.<br>Tidal Marsh Bibliography, Selected Key Work<br>Index (Partially Annotated),<br>W78-07226   | 2L |   |    |
| COLORADO STATE UNIV., FORT COLLINS.<br>DEPT. OF STATISTICS.<br>Nonstationarity of the Mean and the Hurst<br>Phenomenon,<br>W78-07388  | 2E |   |    |   |    |
| COLORADO UNIV., BOULDER. DEPT. O<br>GEOGRAPHY; AND COLORADO UNIV.,<br>BOULDER. INST. OF ARCTIC AND ALPINE<br>RESEARCH.<br>Flooding in Big Thompson River, Colorado,<br>Tributaries: Controls on Channel Erosion and<br>Estimates of Recurrence Interval,<br>W78-07371 | 4D |   |    |   |    |

# ORGANIZATIONAL INDEX

EG AND G WASHINGTON ANALYTICAL SERVICES CENTER, INC., ROCKVILLE, MD.

## EG AND G WASHINGTON ANALYTICAL SERVICES CENTER, INC., ROCKVILLE, MD.

Sampling of Water and Wastewater, W78-07517 5A

## ELKEM-SPIGERVERKET A/S, OSLO (NORWAY). (ASSIGNEE).

Method for Purification of Industrial Waste Water, W78-07247 5D

## ENGINEERING-SCIENCE, INC., AUSTIN, TX.

An Evaluation of Oil and Grease Contamination Associated with Dredged Material Containment Areas. W78-07681 5G

## ENVIRO CONTROL, INC., ROCKVILLE, MD.

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Executive Summary), W78-07563 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Final Report), W78-07567 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Rocky Mountain Region Case Studies), W78-07568 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part A: Rocky Mountains and Pacific Northwest (Pacific Northwest Region Case Studies), W78-07569 6G

## ENVIRONMENTAL PROTECTION AGENCY, ATHENS, GA. SURVEILLANCE AND ANALYSIS DIV.

West Point Lake Postimpoundment Study, W78-07287 5C

## ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH. OFFICE OF RESEARCH AND DEVELOPMENT.

Polish/U.S. Symposium on Wastewater Treatment and Sludge Disposal: Volume II. W78-07530 5D

## ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC.

The EPA General Permit Program, W78-07651 5G

## ENVIRONMENTAL PROTECTION SERVICE, BURLINGTON (ONTARIO). WASTE WATER TECHNOLOGY CENTRE.

Nitrification Systems with Integrated Phosphorus Precipitation, W78-07450 5D

## ENVIRONMENTAL RESEARCH LAB., ADA, OK. OFFICE OF RESEARCH AND DEVELOPMENT.

The Role of EPA's Office of Research and Development in Irrigated Crop Production Research, W78-07607 5G

## ENVIRONMENTAL RESEARCH LAB., ATHENS, GA.

Protonation of Organic Bases in Clay-Water Systems, W78-07364 5B

## EXETER UNIV., (ENGLAND). DEPT. OF BIOLOGICAL SCIENCES.

Taxonomic Studies on Aquatic Hyphomycetes. I. Lemnionia de Wildeman. W78-07271 5A

## EXETER UNIV. (ENGLAND). DEPT. OF BIOLOGICAL SCIENCES.

Photorespiration in Larger Littoral Algae, W78-07274 5C

## FAIRFIELD UNIV., CT. DEPT. OF BIOLOGY.

Detection of Nonpoint Pollution of Small Streams in Southwestern Connecticut, W78-07334 5A

## FEDERAL PAPER BOARD CO., RIEGELWOOD, NC.

A Test and a Technique for Predicting BOD5 Values of Kraft Mill Waste, W78-07597 5A

## FISH AND WILDLIFE SERVICE, JAMESTOWN, ND. NORTHERN PRAIRIE WILDLIFE RESEARCH CENTER.

Productivity of Red-Winged Blackbirds in Prairie Pothole Habitat, W78-07339 2I

## FISH FARMING EXPERIMENTAL STATION, STUTTGART, AR.

Production of Monosex White Amur for Aquatic Plant Control, W78-07326 4A

## FLORIDA STATE UNIV., TALLAHASSEE. DEPT. OF GEOLOGY; AND GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.

Uranium-Isotope Variations in Groundwaters of the Floridan Aquifer and Boulder Zone of South Florida, W78-07343 5B

## FLORIDA UNIV., GAINESVILLE. DEPT. OF CIVIL ENGINEERING.

Hydraulics of Sheet Flow in Wetlands, W78-07340 8B

## FLORIDA UNIV., GAINESVILLE. DEPT. OF SOIL SCIENCE.

Simulation of Nitrogen Movement, Transformations, and Plant Uptake in the Root Zone, W78-07608 5B

## GEOLOGICAL SURVEY, ALBUQUERQUE, NM. WATER RESOURCES DIV.

Drilling, Construction, and Testing of Water-Supply Wells 21 and 22, White Sands Missile Range, Dona Ana County, New Mexico, W78-07352 8B

## GEOLOGICAL SURVEY, AUSTIN, TX. WATER RESOURCES DIV.

Index of Surface-Water Stations in Texas, October 1977. W78-07312 7C

## GEOLOGICAL SURVEY, BAY SAINT LOUIS, MS. WATER RESOURCES DIV.

Downstream-Upstream Reservoir Routing, W78-07344 4A

## GEOLOGICAL SURVEY, BOISE, ID. WATER RESOURCES DIV.

Water Resources of the Weiser River Basin, West-Central Idaho, W78-07342 4A

## GEOLOGICAL SURVEY, CHAMPAIGN, IL. WATER RESOURCES DIV.

Technique for Estimating Magnitude and Frequency of Floods in Illinois. W78-07350 4A

Frequency Analysis of Illinois Floods Using Observed and Synthetic Streamflow Records, W78-07355 4A

## GEOLOGICAL SURVEY, CHEYENNE, WY.

Water Resources Div. Rainfall and Runoff Data from Small Basins in Wyoming. W78-07349 7C

Preliminary Digital Model of the Arikaree Aquifer in the Sweetwater River Basin, Central Wyoming. W78-07351 2F

## GEOLOGICAL SURVEY, DENVER, CO. WATER RESOURCES DIV.

The Use of Galerkin Finite-Element Methods to Solve Mass-Transport Equations, W78-07354 5B

## GEOLOGICAL SURVEY, HELENA, MT. WATER RESOURCES DIV.

Water-Level Changes in Wells Along the West Side of the Cedar Creek Anticline, Southeastern Montana, W78-07357 4B

## GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV., AND COLORADO DEPARTMENT OF HEALTH, DENVER.

Analysis of Waste-Load Assimilative Capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado, W78-07356 5B

## GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.; AND

GEOLOGICAL SURVEY, BAY SAINT LOUIS, MS. WATER RESOURCES DIV. Unsteady-State Water-Quality Model, W78-07348 5B

## GEOLOGICAL SURVEY, LITTLE ROCK, AR. WATER RESOURCES DIV.

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1977 Water Year, W78-07345 4A

## GEOLOGICAL SURVEY, LITTLE ROCK, AZ. WATER RESOURCES DIV.

Water Resources Data for Arkansas, Water Year 1976. W78-07314 7C

## GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.

Description of Wells at Beale Air Force Base and Vicinity, California, W78-07358 4B

Flood-Hazard Study--100-Year Flood Stage for Lucerne Lake, San Bernardino County, California, W78-07359 4A

## GEOLOGICAL SURVEY, PORTLAND, OR. WATER RESOURCES DIV.

Availability and Quality of Ground Water in the Drain-Yoncalla Area, Douglas County, Oregon, W78-07347 7C



**ORGANIZATIONAL INDEX  
INTERNATIONAL WOOL SECRETARIAT, ILKLEY (ENGLAND). TECHNICAL CENTRE.**

- GEOLOGICAL SURVEY, RESTON, VA. LAND INFORMATION AND ANALYSIS OFFICE.**  
The National Land Use Data Program of the U.S. Geological Survey, W78-07316 4A  
Land Use and Environmental Assessment in the Central Atlantic Region, W78-07317 4A
- GEOLOGICAL SURVEY, SALT LAKE CITY, UT. WATER RESOURCES DIV.**  
Seepage Study of the Sevier Valley-Piute Canal, Sevier County, Utah, W78-07360 4A
- GEOLOGICAL SURVEY, ST. PAUL, MN. WATER RESOURCES DIV.**  
Water Resources Data for Minnesota, Water Year 1976, W78-07313 7C
- GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.; DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO); AND COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, NH.**  
Visual Observations of Floating Ice from Skylab, W78-07346 2C
- GEOLOGICAL SURVEY, TRENTON, NJ. WATER RESOURCES DIV.**  
Nitrification in Four Acidic Streams in Southern New Jersey, W78-07353 5C
- GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF CHEMICAL ENGINEERING.**  
Adsorption of Textile Dyes by Activated Carbon Produced from Agricultural, Municipal and Industrial Wastes, W78-07599 5D
- GEORGIA STATE UNIV., ATLANTA. DEPT. OF BIOLOGY.**  
Microbial Interactions with Pesticides in Estuarine Surface Slicks, W78-07605 5C
- GOLDER AND ASSOCIATES, SEATTLE, WA.**  
Salt Loading in Disturbed Watershed-Field Study, W78-07484 5B
- GOSUDARSTVENNYI GIDROLOGICHESKII INST., LENINGRAD (USSR).**  
Methods for Calculating Maximum Flood Discharges for Natural Watercourses and Urban Areas in the U.S.S.R., W78-07697 2A
- GOVIND BALLABH PANT UNIV. OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR (INDIA). DEPT. OF AGRICULTURAL ENGINEERING.**  
Flow to a Nonpenetrating Well in a Leaky Artesian Aquifer with Variable Discharge, W78-07378 2F
- GRONINGEN RIJSUNIVERSITEIT (NETHERLANDS). LAB. FOR CHEMICAL ENGINEERING.**  
The Recovery of Protein From Potato Juice Waste Water by Foam Separation, W78-07592 5D
- GULF COAST RESEARCH LAB., OCEAN SPRINGS, MS.**  
Some Parasites and Diseases of Estuarine Fishes in Polluted Habitats of Mississippi, W78-07546 5C
- HARVARD UNIV., CAMBRIDGE, MA. BIOLOGICAL LAB.**  
Plant Species Diversity in a Marine Intertidal Community: Importance of Herbivore Food Preference and Algal Competitive Abilities, W78-07341 2L
- HAWAII UNIV., HONOLULU. DEPT. OF BOTANY.**  
Antecedent Event Influence on Benthic Marine Algal Standing Crops in Hawaii, W78-07295 2L
- HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER.**  
Rotating Disc Sewage Treatment Systems for Suburban Developments and High-Density Resorts of Hawaii, W78-07393 5D  
Groundwater Recharge and Coastal Discharge for the Northwest Coast of the Island of Hawaii: A Computerized Water Budget Approach, W78-07394 2F  
Handbook-Index of Hawaii Groundwater and Resources Data, Extracted from Reports of the Water Resources Research Center, University of Hawaii, Volume I, W78-07395 7C  
Recycling of Water for Irrigation: Persistence of Enteroviruses in Sewage Effluent and Natural Waters Receiving the Effluent, W78-07471 5B
- HEIDELBERG UNIV. (WEST GERMANY). LAB. FUER SEDIMENTFORSCHUNG.**  
Sedimentary Record of Heavy Metals and Polycyclic Aromatic Hydrocarbons in Lake Constance (In German), W78-07307 5B
- HUDSON (ROBERT (RALETRUX) LTD., LEEDS (ENGLAND).**  
Effluent Treatment Plant for the Smaller Community, W78-07428 5D
- HYDRONAUTICS, INC., LAUREL, MD.**  
The Development of a Hydroperm (TM) Microfiltration System for the Treatment of Domestic Wastewater Effluents, W78-07526 5D
- HYGIENE STANICE HL. M., PRAGUE (CZECHOSLOVAKIA).**  
Preliminary Tests of the Influence of Waste Waters from Sugar Factories on the Numbers of Intestinal Bacteria in Water (In German), W78-07223 5C
- ICHTHYOLOGICAL ASSOCIATES, INC., MIDDLETOWN, DE.**  
Macrobenthos of the Tidal Delaware River Between Trenton and Burlington, New Jersey, W78-07300 5C
- IDAHO UNIV., MOSCOW.**  
Economic Analysis of On-Farm Methods for Controlling Sediment and Nutrient Losses, W78-07627 5G
- IDAHO UNIV., MOSCOW. DEPT. OF AGRICULTURAL ECONOMICS.**  
An Attempt to Quantify the Esthetics of Wild and Scenic Rivers in Idaho, W78-07220 6B
- IDAHO UNIV., MOSCOW. DEPT. OF AGRICULTURAL ENGINEERING.**  
On-Farm Method for Controlling Sediment and Nutrient Losses, W78-07626 5G
- ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.**  
S-Hydrographs and Change of Unit Hydrograph Duration, W78-07385 2A  
Circumferential Diffusion in Pipe Mixing, W78-07488 8B
- ILLINOIS UNIV., AT URBANA-CHAMPAIGN. DEPT. OF URBAN AND REGIONAL PLANNING.**  
Problem Identification and Ranking. An Assessment of a River Basin Planning Process, W78-07687 6B
- INDIAN INST. OF SCIENCE, BANGALORE. DEPT. OF CIVIL ENGINEERING.**  
Design of Constant Accuracy Linear Proportional Weir, W78-07492 8B
- INDIAN INST. OF TECH., KANPUR; AND INDIAN AGRICULTURAL RESEARCH INST., NEW DELHI.**  
Urban Hydrological Modeling and Catchment Research in India, W78-07690 2A
- INSTITUT FUER MEDIZINISCHE MIKROBIOLOGISCHE INFECT.-SEUCHENMED., MUNICH (WEST GERMANY).**  
Stability in Drinking and Surface Water of Nine Virus Species from Different Genera (In German), W78-07272 5C
- INSTITUTE FOR MARINE ENVIRONMENTAL RESEARCH, PLYMOUTH (ENGLAND).**  
Annual Fluctuations in Biomass of Taxonomic Groups of Zooplankton in the California Current, W78-07275 5C
- INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).**  
Some Properties of Variance Reduction Techniques Where Hydrological Extremes Are Estimated by Monte Carlo Simulation, W78-07391 2E  
Urban Hydrological Modeling and Catchment Research in the United Kingdom, W78-07698 2A
- INSTITUTE OF METEOROLOGY AND WATER MANAGEMENT, WARSAW (POLAND).**  
Industrial Waste Management in the Dairy Industry in Poland, W78-07590 5D
- INTERNATIONAL ENVIRONMENTAL BUREAUX FOR THE NON-FERROUS METALS INDUSTRIES, WANTAGE (ENGLAND).**  
Arrestment of Fumes in the Non-Ferrous Metals Industry, W78-07596 5G
- INTERNATIONAL WOOL SECRETARIAT, ILKLEY (ENGLAND). TECHNICAL CENTRE.**  
Chrome Dyeing of Wool: Reducing the Amount of Chromium in the Residual Bath, W78-07601 5D

# ORGANIZATIONAL INDEX

## IODINAMICS CORP., EL PASO, TX. (ASSIGNEE).

### IODINAMICS CORP., EL PASO, TX.

(ASSIGNEE).

Apparatus for Purifying Water,  
W78-07251 5F

### IOWA STATE UNIV., AMES. DEPT. OF AGRONOMY.

Porous Media Tests of Groundwater Mounds,  
W78-07387 2F

### IOWA UNIV., IOWA CITY.

First Four Decades of the Hydraulics Division,  
W78-07382 2A

### IOWA UNIV., IOWA CITY. INST. OF HYDRAULIC RESEARCH.

Flood Damages on the Iowa River,  
W78-07258 4A

### JOHN CASS COLL., LONDON (ENGLAND).

Chlorinated Hydrocarbons in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent,  
W78-07661 5C

### JOHNS HOPKINS UNIV., BALTIMORE, MD. CHESAPEAKE BAY INST.

The Impact of Nitrogen and Phosphorus Release from a Siliceous Sediment on the Overlying Water,  
W78-07302 5C

### JONES AND STOKES ASSOCIATES, INC., SACRAMENTO, CA.

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Executive Summary),  
W78-07564 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish Wildlife, Part B: California (Final Report),  
W78-07565 6G

Assessment of Effects of Altered Stream Flow Characteristics on Fish and Wildlife, Part B: California (Case Studies),  
W78-07566 6G

### JYVASKYLA UNIV. (FINLAND).

A Five-Year Monitoring Study of the Chlorinated Hydrocarbons in the Fish of a Finnish Lake Ecosystem,  
W78-07667 5A

### KARLSRUHE UNIV. (WEST GERMANY). INST. FUER HYDROMECHANIK.

Unified Presentation of Weir-Aeration Data,  
W78-07494 2E

### KEENE CORP., NY. (ASSIGNEE).

Element for Filtering and Separating Fluid Mixtures,  
W78-07240 5D

### KIEV RESEARCH INST. OF GENERAL COMMUNAL HYGIENE (USSR).

Hygienic Evaluation of Effectiveness of Urban Sewage Purification in Oxidation Ponds (In Russian),  
W78-07270 5D

### KYOTO UNIV. (JAPAN). DEPT. OF BOTANY.

Anaerobic ATP Levels in the Blue-Green Alga Anabaena: Dark-Light Transients and Effects of Light Intensity,  
W78-07303 5C

### LANCHESTER POLYTECHNIC, COVENTRY (ENGLAND). DEPT. OF CIVIL ENGINEERING.

Free Surface Flow Computations by Characteristics,  
W78-07493 2E

### LANDESANSTALT FUER WASSER UND ABFALL NORDRHEIN-WESTFALEN, DUSSELDORF (WEST GERMANY).

Urban Hydrology Studies and Mathematical Modeling in the Federal Republic of Germany,  
W78-07696 2A

### LOS ALAMOS SCIENTIFIC LAB., NM.

Hot Dry Rock Geothermal Energy Development Project: Annual Report, Fiscal Year 1977,  
W78-07572 8B

### LOS ANGELES COUNTY SANITATION DISTRICTS, WHITTIER, CA.

Independent Physical-Chemical Treatment of Raw Sewage,  
W78-07516 5D

### LOS ANGELES ORANGE COUNTY METROPOLITAN AREA, WHITTIER, CA.

Effect of Thermal Pretreatment on Digestibility and Dewaterability of Organic Sludges,  
W78-07457 5D

### LOS ANGELES ORANGE COUNTY METROPOLITAN WHITTIER, CA.

Los Angeles Faces Several Sludge Management Problems,  
W78-07448 5D

### LOUISIANA STATE UNIV., BATON ROUGE. CENTER FOR WETLAND RESOURCES.

Development of a Two Dimensional Hydrodynamic Numerical Model for Use in a Shallow, Well-Mixed Estuary,  
W78-07408 2L

### LUND INST. OF TECH. (SWEDEN); AND DEPT. OF WATER RESOURCES ENGINEERING.

Urban Hydrological Modeling and Catchment Research in Sweden,  
W78-07695 2A

### LUND UNIV. (SWEDEN); AND LUND INST. OF TECH. (SWEDEN). DEPT. OF NUCLEAR PHYSICS.

Medically Used Radionuclides in Sewage Sludge,  
W78-07460 5A

### LUND UNIV. (SWEDEN). LIMNOLOGICAL INST.

Evolutionary Studies on the Shape of the Cell and of the Chloroplast in Desmids,  
W78-07283 2I

Morphological Investigations of Asymmetry in Desmids,  
W78-07284 2I

Eulimnion, an Original Place of New Forms,  
W78-07285 5C

### MANN (ROY) ASSOCIATES, INC., CAMBRIDGE, MA.

Planning Guidelines for Residential and Path Development in Michigan's Sand Dunes and Wetlands,  
W78-07227 4A

### MARYLAND UNIV., BALTIMORE COUNTY, BALTIMORE. DEPT. OF BIOLOGICAL SCIENCES.

Adaptation of Copepod Populations to Thermal Stress, II,  
W78-07398 5C

### MARYLAND UNIV., COLLEGE PARK. DEPT. OF AGRICULTURE ENGINEERING.

Modeling Salt Transport in the Irrigated Soils of Grand Valley,  
W78-07648 5B

### MASSACHUSETTS INST. OF TECH. CAMBRIDGE. DEPT. OF CIVIL ENGINEERING.

Two-Dimensional Plume in Uniform Ground-Water Flow,  
W78-07490 5B

Copper Sensitivity of Gonyaulax Tamarensis,  
W78-07664 5C

### MASSACHUSETTS INST. OF TECH., CAMBRIDGE. MA. CONSTRUCTED FACILITIES DIV.

Sizing of Containment Areas for Dredged Material,  
W78-07674 5E

### MASSACHUSETTS METROPOLITAN DISTRICT COMMISSION, BOSTON.

Cottage Farm Combined Sewer Detection and Chlorination Station, Cambridge, Massachusetts,  
W78-07534 5D

### MASSACHUSETTS UNIV., AMHERST. DEPT. OF CIVIL ENGINEERING.

Nitrogen Transformations in Land Treatment,  
W78-07216 5B

### MASSACHUSETTS UNIV., WALTHAM. DEPT. ENVIRONMENTAL SCIENCES.

The Relationship of Lake Quality to Specific Urbanization Stresses,  
W78-07204 5C

### MASSACHUSETTS UNIV., WALTHAM. DEPT. OF ENVIRONMENTAL SCIENCES.

A Test of the Effects of Domestic Sewage on the Growth of the Common Blue Mussel, Mytilus Edulis, in an Aquacultural System,  
W78-07205 5C

### MESA NEW YORK BIGHT PROJECT OFFICE, ALBANY.

Circulation. MESA New York Bight Atlas Monograph 3,  
W78-07541 2L

Water Quality. MESA New York Bight Atlas Monograph 27,  
W78-07542 5B

### META SYSTEMS INC., CAMBRIDGE, MA.

Urban Runoff Pollution Control-State-of-the-Art,  
W78-07335 5G

### METCALF AND EDDY, INC., BOSTON, MA.

National Needs for Combined Sewer Overflow Control,  
W78-07422 5D

### MEYER, MEYER, LACROIX AND HIXSON, ALEXANDRIA, LA.

Dye Waste Treatment and Reuse,  
W78-07600 5D

### MICHIGAN UNIV., ANN ARBOR. DEPT. OF CIVIL ENGINEERING.

Innovative Management Concept for 208 Planning,  
W78-07222 5G

### MICHIGAN UNIV., ANN ARBOR, SCHOOL OF NATURAL RESOURCES.

Background Ecology and the Effects of Nutrient Additions on a Central Michigan Wetland,  
W78-07279 5C

# ORGANIZATIONAL INDEX

NATIONAL WEATHER SERVICE, SILVER SPRING, MD. OFFICE OF HYDROLOGY.

## MINNESOTA UNIV. MINNEAPOLIS. DEPT. OF CIVIL AND MINERAL ENGINEERING.

Clinoptilolite Column Ammonia Removal Model.  
W78-07466 5D

Effluent Mixing Zone in a Shallow River,  
W78-07483 5B

## MISSOURI UNIV.-COLUMBIA. DEPT. OF CHEMICAL ENGINEERING.

Particle Disruption in Flocculating Systems,  
W78-07321 5F

## MISSOURI UNIV., COLUMBIA. DEPT. OF GEOLOGY.

Relationship Between Groundwater Resources and Energy Production in Southwestern Missouri,  
W78-07202 2K

Scour and Fill in Steep, Sand-Bed Ephemeral Streams,  
W78-07379 2J

## MISSOURI UNIV.-ROLLA. DEPT. OF CHEMISTRY.

The Role of Surface Microlayer of Water in the Distribution and Fate of Trace Organic Contaminants; A Feasibility Study,  
W78-07319 5B

## MITSUBISHI RAYON CO., LTD., TOKYO (JAPAN). (ASSIGNEE).

Method for Clarifying Waste Water Containing Finely Divided Oily Materials,  
W78-07245 5D

## MONTGOMERY (JAMES M.) INC., WALNUT CREEK, CA.

Phosphorus Removal by Precipitation with FE (III),  
W78-07465 5D

## MONTPELLIER-2 UNIV. (FRANCE). LAB. D'HYDROLOGIE MATHEMATIQUE.

Urban Hydrological Modeling and Catchment Research in France,  
W78-07694 2A

## MOODY AND ASSOCIATES, MEADVILLE, PA.

Well Field Management,  
W78-07577 4B

## MOSKOVISKII GOSUDARSTVENNYI

## MEDITSINSKII INST. (I) (USSR). DEPT. OF GENERAL HYGIENE.

The Effect of Chemicals on Some Microbial Self-Purification Processes in Bodies of Water (In Russian),  
W78-07298 5C

## MOSS LANDING MARINE LAB. CA.

Patterns of Succession in Benthic Infaunal Communities Following Dredging and Dredged Material Disposal in Monterey Bay,  
W78-07677 5C

## MUNICIPAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OH. WASTEWATER RESEARCH DIV.

Concepts, Criteria, and Measurements of Biodegradability,  
W78-07532 5D

## NALCO CHEMICAL CO., OAK BROOK, IL. (ASSIGNEE).

Removal of Color from Paper Mill Waste Waters,  
W78-07238 5D

## NATIONAL ASSOCIATION OF REGIONAL COUNCILS, WASHINGTON, DC.

Marine Waste Disposal in the New York Bight-Public Policy, Environmental Impacts, and Alternative Futures,  
W78-07529 5E

## NATIONAL CHEMICAL LAB. FOR INDUSTRY, TOKYO (JAPAN).

Concentration of Acetic Acid in Sulfite Pulp Evaporation Drain by Reverse Osmosis,  
W78-07598 5D

## NATIONAL ENFORCEMENT

## INVESTIGATIONS CENTER, DENVER, CO.

Preservation of Phenolic Compounds in Wastewaters,  
W78-07586 5D

## NATIONAL ENVIRONMENTAL RESEARCH CENTER, CINCINNATI, OH. ADVANCED

## WASTE TREATMENT RESEARCH LAB.

Missouri River Basin Sterol Assay Project Report. Coprostanol, A Positive Marker of Domestic and Run-Off Pollution: Sterol Assay of Wastewater Plant Effluents and Surface Waters of the Lower Main Stem Missouri,  
W78-07328 5A

Mississippi River Basin Sterol Assay Project Report. Coprostanol, A Positive Molecular Marker of Domestic and Run-Off Sewage, Wastewater Plant Effluent and Surface Waters in the Burlington, Iowa Area on the Mississippi River,  
W78-07329 5A

## NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).

The Dangers of Inadequate Chlorination of Polluted Waters,  
W78-07435 5D

## NATIONAL MARINE FISHERIES SERVICE, BEAUFORT, NC. BEAUFORT LAB.

Effect of Chemical Speciation on Toxicity of Cadmium to Grass Shrimp, Palaemonetes Pugio: Importance of Free Cadmium Ion,  
W78-07662 5C

## NATIONAL MARINE FISHERIES SERVICE, PANAMA CITY, FL. GULF COASTAL FISHERIES CENTER.

Physical, Chemical, and Biological Characteristics of Nearshore Zone of Sand Key, Florida, Prior to Beach Restoration. Vol. 1,  
W78-07407 2J

## NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA. NORTHWEST AND ALASKA FISHERIES CENTER.

Pollution in the Northeast Pacific Ocean,  
W78-07325 5B

## NATIONAL MARINE FISHERIES SERVICES, SEATTLE, WA.

Surface Currents as Determined by Drift Card Releases Over the Continental Shelf Off Central and Southern California,  
W78-07556 5B

## NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, CO. MARINE ECOSYSTEMS ANALYSIS PROGRAM OFFICE.

Nearshore Fish and Macroinvertebrate Assemblages Along the Strait of Juan de Fuca Including Food Habits of Nearshore Fish,  
W78-07543 2L

Evaluation of Water Quality of Puget Sound and Hood Canal in 1976,  
W78-07544 5C

Surface Drifter Movements Observed in Outer Strait of Juan de Fuca, July 1977,  
W78-07545 5B

The 1973 Bathymetric Survey in the New York Bight Apex: Maps and Geological Implications,  
W78-07548 2L

## NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, CO. OUTER CONTINENTAL SHELF ENVIRONMENTAL ASSESSMENT PROGRAM.

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter April - June 1977.  
W78-07558 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter April - June 1977.  
W78-07559 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume I. Principal Investigators' Reports for the Quarter July - September 1977.  
W78-07560 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume II. Principal Investigators' Reports for the Quarter July - September 1977.  
W78-07561 6G

Environmental Assessment of the Alaskan Continental Shelf. Volume III. Principal Investigators' Reports for the Quarter July - September 1977.  
W78-07562 6G

## NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FL. ATLANTIC OCEANOGRAPHIC AND ATMOSPHERIC LABS.; AND NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FL. MARINE GEOLOGY AND GEOPHYSICS LAB.

Suspended-Matter Distribution in the New York Bight Apex Related to Hurricane Belle,  
W78-07509 2L

## NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, DC. ENVIRONMENTAL DATA SERVICE.

U.S. IFYGL Ship System: Description of Archived Data,  
W78-07554 2H

## NATIONAL SPACE TECHNOLOGY LABS., BAY SAINT LOUIS, MS.

Water Hyacinths and Alligator Weeds for Final Filtration of Sewage,  
W78-07299 5D

## NATIONAL WATER WELL ASSOCIATION, WORTHINGTON, OH.

NWWA's Most Requested Statistics,  
W78-07582 8A

## NATIONAL WEATHER SERVICE, SILVER SPRING, MD. OFFICE OF HYDROLOGY.

Derivation of Initial Soil Moisture Accounting Parameters from Soil Properties for the National Weather Service River Forecast System,  
W78-07551 2G

# ORGANIZATIONAL INDEX

## NAVAL ACADEMY, ANNAPOLIS, MD. DEPT. OF OCEANOGRAPHY.

### NAVAL ACADEMY, ANNAPOLIS, MD. DEPT. OF OCEANOGRAPHY.

Management of the Northern Chesapeake Bay American Shad Fishery,  
W78-07337 6B

### NEBRASKA UNIV., LINCOLN. DIV. OF NATURAL RESOURCES, CONSERVATION AND SURVEY.

Nonpoint Nitrate Contamination of Ground Water in Merrick County, Nebraska,  
W78-07506 5B

### NELSON (L. R.) CORP., PEORIA, IL. (ASSIGNEE).

Traveling Sprinkler Guide Wheel Assembly,  
W78-07244 3F

### NEW HAMPSHIRE UNIV., DURHAM. DEPT. OF BOTANY AND PLANT PATHOLOGY.

Distribution, Growth, and Phosphorus Relationships of Myriophyllum Heterophyllum Michx. in Lake Winnepesaukee, New Hampshire,  
W78-07482 5C

### NEW MEXICO STATE UNIV., UNIVERSITY PARK.

Economics of Controlling Irrigation Return Flow in the Mesilla Valley, New Mexico,  
W78-07635 5G

### NEW MEXICO STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRICULTURAL ENGINEERING.

Application of Modern Irrigation Technology in the Mesilla Valley, New Mexico,  
W78-07634 3C

### NEW MEXICO STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRONOMY.

Solute Transport Through Soil with Nonuniform Water Content,  
W78-07496 2G  
Effects of Irrigation Management on Soil Salinity and Return Flow Quality,  
W78-07619 5G

### NEW ORLEANS UNIV., LA. DEPT. OF BIOLOGICAL SCIENCES.

The Impact of the 1975 Bonnet Carré Spillway Opening on Epifaunal Invertebrates in Southern Lake Pontchartrain,  
W78-07219 5C

### NEW YORK SEA GRANT INST., ALBANY.

Industrial Wastes, MESA New York Bight Atlas Monograph 30,  
W78-07547 5B

### NEW YORK STATE DEPT. OF HEALTH, ALBANY. ENVIRONMENTAL HEALTH CENTER.

Restoration of Lower St. Regis Lake (Franklin County, New York),  
W78-07291 5G

### NEW YORK STATE LEGISLATURE, ALBANY.

Modernization and Improvement of New York's Riparian Law,  
W78-07410 6E

### NEW ZEALAND GEOLOGICAL SURVEY, CHRISTCHURCH.

Hydrogeology of Metropolitan Christchurch,  
W78-07368 4B

### NEWCASTLE-UPON-TYNE UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING; AND

### NEWCASTLE-UPON-TYNE UNIV. (ENGLAND). PUBLIC HEALTH ENGINEERING DIV.

Treatment of Some Industrial Effluents in Malaysia,  
W78-07602 5D

### NORGES VASSDRAGS- OG ELEKTRISITETSVENSEN, OSLO. HYDROLOGICAL DIV.

Urban Hydrological Modeling and Catchment Research in Norway,  
W78-07693 2A

### NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF CIVIL ENGINEERING.

Comparison of Numerical Simulation Flow Models for Coastal Inlets,  
W78-07472 2L

### NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF GENETICS.

A Comparative Study of the Effects of Mercuric Chloride and Methyl Mercury Chloride on Reproductive Performance in the Brine Shrimp, Artemia Salina,  
W78-07668 5C

### NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF BACTERIOLOGY.

Virion Aggregation and Disinfection of Water Viruses by Bromine,  
W78-07524 5F

### NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF ENVIRONMENTAL SCIENCES AND ENGINEERING.

Alum Treatment of High-Rate Trickling Filter Effluent at Chapel Hill, North Carolina,  
W78-07409 5D

### NORTH CAROLINA WATER RESOURCES RESEARCH INST., RALEIGH.

Summary Report - The Chowan River Project,  
W78-07318 5C

### NORTH DAKOTA STATE UNIV., FARGO. DEPT. OF MECHANICAL ENGINEERING.

Wind Powered Artificial Aeration of Northern Prairie Lakes,  
W78-07201 8C

### NORTH DAKOTA STATE UNIV., FARGO. DEPT. OF ZOOLOGY.

An Analytical Evaluation of the Utilization and Management of Water Resources in the Lake Metigoshe Watershed, North Dakota,  
W78-07209 5C

### NORTH DAKOTA UNIV., GRAND FORKS. DEPT. OF PHYSICS.

Determination of Trace Elements in the English Coulee System: Presence Due to Extended Lignite Burning,  
W78-07208 5A

### NORTH TEXAS STATE UNIV., DENTON. INST. OF APPLIED SCIENCES; AND NORTH TEXAS STATE UNIV., DENTON. DEPT. OF CHEMISTRY.

Total Organic Halogen as Water Quality Parameter: Adsorption/Microcoulometric Method,  
W78-07273 5A

### OAK RIDGE NATIONAL LAB., TN.

Cross-Flow Filtration in Physical-Chemical Treatment of Municipal Sewage Effluents,  
W78-07533 5D

### OAK RIDGE NATIONAL LAB., TN. COMPUTER SCIENCES DIV.

Linsed: A One Dimensional Multireach Sediment Transport Model,  
W78-07363 2J

### OAK RIDGE NATIONAL LAB., TN., ENVIRONMENTAL SCIENCES DIV.

COPEPOD4: A Discrete Time-Delay Model of Copepod Population Dynamics,  
W78-07289 5B

### OHIO STATE UNIV., COLUMBUS. DEPT. OF CIVIL ENGINEERING.

Studies on the Toxicity of Ammonia, Nitrate and their Mixtures to Guppy Fry,  
W78-07214 5C

### OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF CIVIL ENGINEERING.

Make Wastewater More Versatile: Reuse it for Recreation Lakes,  
W78-07217 5D

### OKLAHOMA STATE UNIV., STILLWATER. SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING.

Hydraulic Modeling of Mixing in Stratified Lakes,  
W78-07218 5B

### OREGON STATE ENGINEERS OFFICE, SALEM. WATERSHED PLANNING DIV.

An Engineering Report on Selected Reservoir Sites in the Bandon Area,  
W78-07280 6B

### OREGON STATE UNIV., CORVALLIS. DEPT. OF CIVIL ENGINEERING.

Linear and Nonlinear Wave Action Estimates,  
W78-07485 2L

### OREGON STATE UNIV., CORVALLIS. DEPT. OF FISHERIES AND WILDLIFE.

Temperature Requirements of Salmonids in Relation to their Feeding, Bioenergetics, Growth and Behavior,  
W78-07322 5C

### OREGON STATE UNIV., CORVALLIS. DEPT. OF OCEAN ENGINEERING.

Use of Benthic Sediments as Indicators of Marina Flushing,  
W78-07553 5A

### OREGON WATER RESOURCES BOARD, SALEM.

Freshwater Resources of the Oregon Coastal Zones,  
W78-07281 2L

Irrigation Water Supply Study for Red Prairie Irrigation District, Polk and Yamhill Counties, Oregon,  
W78-07282 3F

### PENNSYLVANIA DEPT. OF ENVIRONMENTAL RESOURCES, HARRISBURG.

Formulating State Groundwater Policy in Pennsylvania,  
W78-07576 5G

### PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.

Groundwater Tracing with Post Sampling Activation Analysis Using Bromide and Iodide Ions Injected Simultaneously into a Shallow-Well System,  
W78-07683 5B



# ORGANIZATIONAL INDEX

STATE UNIV., OF NEW YORK AT BUFFALO. DEPT. OF CIVIL ENGINEERING.

|           |   |    |   |    |  |    |
|-----------|---|----|---|----|--|----|
| Sediment  | Factors Involved in the Resistance of Brook Trout to Sulfuric Acid Solutions and Mine Acid Polluted Waters, W78-07684   | 5C | RICKEL MFG. CORP., KANSAS CITY, MO. Sludge Disposal: The Problem, The Solution, W78-07424   | 5D | SCS ENGINEERS, LONG BEACH, CA. Monitoring in the Zone of Aeration, W78-07470   | 5A |
| 2J        | An Energy Model of Pennsylvania, W78-07685  | 6A | RIJKSDIENST VOOR DE IJSELMEERPOLDERS, LELYSTAD (NETHERLANDS). Urban Hydrological Modeling and Catchment Research in the Netherlands, W78-07692                                  | 2A | Feasibility of Inland Disposal of Dewatered Dredged Material: A Literature Review, W78-07682   | 5E |
| Model of  | Soil Strength and Soil Temperature: Their Effects on Root Growth of Tall Fescue, W78-07688  | 2G | ROBERT S. KERR ENVIRONMENTAL RESEARCH LAB., ADA, OK. Nutrient, Bacterial, and Virus Control as Related to Ground Water Contamination, W78-07571                                 | 5B | SEAFOOD TECHNOLOGY LABORATORY, BRUNSWICK, GA.; AND GEORGIA UNIV., EXPERIMENT, GA. DEPT. OF FOOD SCIENCE. Effect of Time of Deacetylation on Molecular Weight Distribution, Acetyl Content, Viscosity, and Performance of Chitsan as a Conditioning Agent for Activated Sludge, W78-07552 | 5D |
| OF        | PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. SPACE SCIENCE AND ENGINEERING LAB. Floodplain Delineation Using LANDSAT-1 Data, W78-07510                                      | 4A | ROORKEE UNIV. (INDIA). DEPT. OF CIVIL ENGINEERING. Drag on Baffle Walls in Hydraulic Jump, W78-07491  | 8B | SHIMEK, ROMING, JACOBS AND FINKLEA, DALLAS, TX. Process Design Manual for Phosphorus Removal, W78-07527  | 5D |
| Nitrate   | PHILIPS ENVIRONMENTAL PROTECTION, EINDHOVEN (NETHERLANDS). Instrumentation and Automation in Water and Wastewater Treatment, W78-07525                                    | 5A | RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING. Dielectric Constant and Electroconductance of Some Dry Frost-Prone Soils, W78-07369 | 2C | SHINSHU UNIV., MATSUMOTO (JAPAN). DEPT. OF CHEMICAL ENGINEERING. Kinetic Studies on the Lime Sulfurated Solution (Calcium Polysulfide) Process for Removal of Heavy Metals from Waste Water, W78-07595   | 5D |
| 5C        | PITTSBURGH UNIV., PA. DEPT. OF CIVIL ENGINEERING. Ozonation of Coal Gasification Plant Wastewater, W78-07589  | 5A | SAINT JOHNS RIVER WATER MANAGEMENT DISTRICT, PALATKA, FL. Orifice Effects on Oscillatory Flow, W78-07487  | 8B | SIMON FRASER UNIV., BURNABY (BRITISH COLUMBIA). DEPT. OF GEOGRAPHY. Variation of Drainage Density in a Small British Columbia Watershed, W78-07505   | 4D |
| R.        | POLISH ACADEMY OF SCIENCES, GDANSK. INST. OF HYDRAULIC RESEARCH. Boundary Conditions in Modeling Water Flow in Unsaturated Soils, W78-07503                               | 2G | SALCO PRODUCTS, INC., HAWTHORNE, CA. (ASSIGNEE). Self Cleaning, Pressure Responsive Emitter Valve for Soil Irrigation, W78-07243  | 3F | SKIDAWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA. The Results of Four Oceanographic Cruises in the Georgia Bight, W78-07537  | 2L |
| it for    | POLYBAR CORP., NY. Mutant Bacteria Solve BOD Problem at Heat Packing Plant, W78-07603   | 5D | SALFORD UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING. Forced Plumes in a Stratified Reservoir, W78-07489   | 8B | SNOWY MOUNTAINS ENGINEERING CORP., COOMA (AUSTRALIA). Urban Hydrological Modeling and Catchment Research in Australia, W78-07699   | 2A |
| 5D        | PRO-TECH, INC., PAOLI, PA. (ASSIGNEE). Flow Monitoring Apparatus, W78-07236   | 5D | SAN JOAQUIN VALLEY INTERAGENCY DRAINAGE PROGRAM, FRESNO, CA. A Valleywide Solution--The Interagency Drainage Program, W78-07639   | 4A | SOIL CONSERVATION SERVICE, PHOENIX, AZ. Wellton-Mohawk On-Farm Systems Improvement Program, W78-07645  | 3C |
| R.        | PUBLIC TECHNOLOGY, INC., WASHINGTON, DC. European Water Treatment Practices and What We Can Learn from Them, W78-07604  | 5F | SANTIAGO UNIV. (SPAIN). DEPT. OF MICROBIOLOGY. Method of Average Birth and Death Rate Evaluation in the Marine-Terrestrial Bacteria Interactions, W78-07263                     | 5C | SOUTH DAKOTA STATE PLANNING BUREAU, PIERRE; AND GEOLOGICAL SURVEY, SIOUX FALLS, SD. EROS DATA CENTER. The South Dakota Cooperative Land use Effort: A State Level Remote Sensing Demonstration Project, W78-07315  | 4A |
| SPACE     | PYE UNICAM LTD., CAMBRIDGE (ENGLAND) ACUV APPLICATIONS LABS. The Background to, and the Application of, Laboratory Instrumentation to Water Analysis, W78-07458           | 5A | IBM 1130 Computation Process in the Study of Biophysical Constants Variations of Pathogenous Bacteria by Phytoplankton, W78-07264   | 5C | SOUTHERN CALIFORNIA UNIV., LOS ANGELES. DEPT. OF BIOLOGICAL SCIENCES. Marine Pollution Hazards, W78-07297  | 5C |
| ified     | QUEEN'S UNIV., KINGSTON (ONTARIO). DEPT. OF GEOLOGICAL SCIENCES. A Coring and Squeezing Technique for the Detailed Study of Subsurface Water Chemistry, W78-07575         | 2K | SASKATCHEWAN UNIV., REGINA. DEPT. OF CIVIL ENGINEERING. Generation of Ungaged Streamflow Data, W78-07384  | 2A | SOUTHERN ILLINOIS UNIV. AT CARBONDALE. FISHERIES RESEARCH LAB. Use of Zooplanktophagic Fishes in Channel Catfish Production Ponds, W78-07292   | 5C |
| 5B        | RESEARCH ASSOCIATION FOR THE PAPER AND BOARD PRINTING AND PACKAGING INDUSTRIES, SURREY (ENGLAND). Sewage Fungus Growth in Rivers Receiving Paper Mill Effluent, W78-07655 | 5C | SCIENCE APPLICATIONS, INC., BOULDER, CO. Environmental Assessment of the Alaskan Continental Shelf. Annual Reports Summary for the Year Ending March 1977, W78-07557            | 6G | STATE UNIV., OF NEW YORK AT BUFFALO. DEPT. OF CIVIL ENGINEERING. Inventory of Lake Ontario Inlets and Harbors: Niagara River to Stony Creek, W78-07225   | 2H |
| Reservoir | RESEARCH INST. ON ENVIRONMENTAL DEVELOPMENT, WARSAW (POLAND). Urban Runoff Research in Poland, W78-07691  | 2A | SCS ENGINEERS, INC., LONG BEACH, CA. Reuse of Municipal Wastewater for Groundwater Recharge, W78-07570  | 5D | pH Averaging, W78-07456  | 5A |
| 6B        | RHODE ISLAND UNIV., KINGSTON. DEPT. OF OCEAN ENGINEERING. Generation of Tidal Current and Height Charts for Narragansett Bay Using a Numerical Model, W78-07555           | 2L |   |    |  |    |

# ORGANIZATIONAL INDEX

## STATE UNIV., OF NEW YORK AT BUFFALO. DEPT. OF CIVIL ENGINEERING.

### STATE UNIV. OF NEW YORK AT BUFFALO.

#### DEPT. OF INDUSTRIAL ENGINEERING.

Nonstructural Floodplain Planning,  
W78-07221 6F

### STATE UNIV. OF NEW YORK AT STONY BROOK. MARINE SCIENCES RESEARCH CENTER.

Nutrient Distributions and Transport in Long  
Island Sound,  
W78-07550 5B

### SURREY UNIV., GUILFORD (ENGLAND).

The Behavior of F2 Coliphage in Activated  
Sludge Treatment,  
W78-07461 5D

### TECHNICAL UNIV. OF DENMARK, LYNGBY. INST. OF HYDRODYNAMICS AND HYDRAULIC ENGINEERING.

Sedimentation of River Navigation Channels,  
W78-07486 2J

### TEXAS A AND M UNIV., COLLEGE STATION.

Shoreline Plant Establishment and Use of a  
Wave-Stilling Device,  
W78-07230 2L

### TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF CIVIL ENGINEERING.

Environmental Management of a Ship Channel-  
Harbor Complex,  
W78-07539 5B

Technical and Philosophical Aspects of Ocean  
Disposal,  
W78-07540 5E

### TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF SOIL AND CROP SCIENCES; AND TEXAS AGRICULTURAL EXPERIMENT STATION, COLLEGE STATION.

Nitrate Movement in Clay Soils and Methods  
of Pollution Control,  
W78-07609 5B

### TEXAS A AND M UNIV., COLLEGE STATION. OCEAN ENGINEERING PROGRAM.

Environmental Considerations Relating to  
Operation and Maintenance of the Texas Gulf  
Intracoastal Waterway,  
W78-07538 2L

### TEXAS A AND M UNIV., EL PASO. RESEARCH CENTER.

Effects of Wetting Agents on Water Infiltration  
into Water-Repellent Coal Mine Spoils,  
W78-07370 5G

### TEXAS AGRICULTURAL EXPERIMENT STATION, LUBBOCK.

Effect of Three Irrigation Systems on Distribu-  
tion of Fertilizer Nitrate Nitrogen in Soil,  
W78-07610 5B

Effect of Irrigation Systems on Water Use Ef-  
ficiency and Soil Water Solute Concentrations,  
W78-07620 5G

### TEXAS UNIV. AT AUSTIN. DEPT. OF CIVIL ENGINEERING.

State Variable Model for Sewer Network Flow  
Routing,  
W78-07212 8B

### TORO CO., SAN MARCOS, CA. (ASSIGNEE).

Moisture Sensing Apparatus and Method,  
W78-07242 3F

### UDAIPUR UNIV. (INDIA). DEPT. OF ZOOLOGY.

Improved Under-Water Sampler for Limnologi-  
cal Work,  
W78-07276 7B

### UNION CARBIDE CORP., TONAWANDA, NY. ENVIRONMENTAL SYSTEMS DEPT.

New System Cuts Phosphorus for Less Cost,  
W78-07301 5D

Air vs 02: Two Activated Sludge Systems Com-  
pared,  
W78-07451 5D

### UNIVERSAL OIL PRODUCTS, ST. PAUL, MN. JOHNSON DIV.

Packers and Seals Serve Many Uses,  
W78-07585 8C

### UNIVERSITY OF SOUTHWESTERN LOUISIANA. LAFAYETTE.

Greenhouse Studies of the Growth and  
Reproduction of Egeria Densa,  
W78-07401 4A

### UNIVERSITY OF WEST FLORIDA, PENSACOLA. WATER RESOURCES RESEARCH CENTER.

Water-Column and Benthic Invertebrate and  
Plant Associations as Affected by the Physico-  
Chemical Aspects in a Mesotrophic Bayou  
Estuary Pensacola, Florida,  
W78-07203 5C

### UNWELTBUNDESAMT, BERLIN (WEST GERMANY).

Plants and Systems for Composting of Sewage  
Sludges in the Federal Republic of Germany--  
State of the Art and Trends (Anlagen und  
Systeme zur Kompostierung von Abwas-  
serschlaemmen in der Bundesrepublik  
Deutschland--Stand sowie Tendenzen),  
W78-07449 5E

### UTAH STATE UNIV., LOGAN. DEPT. OF AGRICULTURAL AND IRRIGATION ENGINEERING.

Field Evaluation of Sprinkler Irrigation for  
Management of Irrigation Return Flow,  
W78-07618 5G

### UTAH STATE UNIV., LOGAN. DEPT. OF SOIL SCIENCE AND BIOMETEOROLOGY.

Modeling Salinity of Irrigation Return Flow  
Where Sources and Sinks are Present,  
W78-07617 5B

### UTAH UNIV., SALT LAKE CITY. DEPT. OF CHEMICAL ENGINEERING.

The Production of Protein from Municipal  
Sludge,  
W78-07447 5D

### VERMONT UNIV., BURLINGTON. DEPT. OF GEOLOGY.

Sediment Thicknesses, Eastern Lake Cham-  
plain,  
W78-07686 2J

### VICKERYS LTD., LONDON (ENGLAND).

Starch-Laden Effluent Treatment-A Case His-  
tory,  
W78-07591 5D

### VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.

City of Newport News and Fort Eustis Tidal  
Marsh Inventory,  
W78-07224 2L

Delineation of Tidal Wetlands Boundaries in  
Lower Chesapeake Bay and its Tributaries,  
W78-07229 2L

### VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT. WETLANDS RESEARCH SECTION.

York County and Town of Poquoson Tidal  
Marsh Inventory,  
W78-07310 2L

Northumberland County Tidal Marsh Inven-  
tory,  
W78-07311 2L

### VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.

Maximizing Phosphorus Removal in Activated  
Sludge,  
W78-07446 5D

### VIRGINIA UNIV., CHARLOTTESVILLE.

Implementing Cost-Effective Pollution Control  
by Means of Effluent Charges: An Example  
Applied to Electroplating Discharges,  
W78-07481 5G

### VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF CIVIL ENGINEERING.

New Procedure Determines Aerobic Sludge  
Stability,  
W78-07464 5D

### VSESOYUZNYI NAUCHNO- ISSEDOVATELSKII INST. GIDROTEKHNIKI I MELIORATSII, YAKUTSK (USSR).

Temperature Regime of Low-Head Earth Dams  
in Central Yakutia,  
W78-07512 8D

### VYSKUMNY USTAV ONKOLOGICKY, BRATISLAVA (CZECHOSLOVAKIA).

Microbiological Aspects of Pollution and Self-  
Purification of the Water of the River Danube  
on its Czechoslovak Section (In German),  
W78-07267 5C

### WASHINGTON STATE DEPT. OF ECOLOGY, OLYMPIA.

Irrigation Return Flow Problems in Yakima  
Valley,  
W78-07640 5G

The Sulphur Creek Pilot Project: A Practical  
Approach to Control of Pollutants Leaving Ir-  
rigated Farmlands,  
W78-07641 5G

The '208' Planning Effort for Irrigated Agricul-  
ture in the State of Washington,  
W78-07642 5G

### WASHINGTON STATE UNIV., PULLMAN. DEPT. OF AGRONOMY AND SOILS.

Nitrogen and Water Management to Minimize  
Return-Flow Pollution from Potato Fields of  
the Columbia Basin,  
W78-07611 5G

### WASHINGTON STATE UNIV., PULLMAN. DEPT. OF POLITICAL SCIENCE.

Instream Flow Decision-Making in the Pacific  
Northwest,  
W78-07480 6E

### WASHINGTON UNIV., SEATTLE.

Solubilization of Organic Carbon During the  
Acid Phase of Anaerobic Digestion,  
W78-07518 5D

### WASHINGTON ZOOLOGY; A SEATTLE. DI SCIENCES.

North Ame  
75,000 Year  
W78-07372

### WEHRWISS. BUNDESWEI (WEST GER)

Detoxificat  
B in Water  
W78-07232

### WESTERN R BERKELEY.

Binding o  
dehyde-Po  
W78-07594

### WESTLAND CA.

Local Solu  
W78-07638

### WICHITA S KS.

Grouting  
Maintenan  
W78-0742

### WISCONSIN RESEARCH

Effects of  
Wildlife a  
Marsh, W  
W78-0722

### WISCONSIN RESOURCE

Northern  
Spawning  
W78-0729

### WISCONSIN GEOLOGY

Impact of  
System of  
W78-0737

### WISCONSIN SCIENCE.

Steady-St  
sions with  
W78-0738

### WOODS HO INSTITUTE

OCEAN MA  
Sub-Seab  
Preventio  
W78-0752

### WORCESTER DEPT. OF

Capacity  
Treatmen  
W78-0752

### WYOMING

Case No  
ing the L  
Irrigation  
615(N.M  
3426(No  
W78-072

# ORGANIZATIONAL INDEX

YOUNGSTOWN STATE UNIV., OH. DEPT. OF CHEMICAL ENGINEERING.

## WASHINGTON UNIV., SEATTLE. DEPT. OF ZOOLOGY; AND WASHINGTON UNIV., SEATTLE. DEPT. OF GEOLOGICAL SCIENCES.

North American Glacial History Extended to 75,000 Years Ago,  
W78-07372 2C

## WYOMING UNIV., LARAMIE. WATER RESOURCES RESEARCH INST.

Water Quality Model for the Upper North Platte River,  
W78-07206 5B

Economic and Agronomic Effects of High Irrigation Levels on Alfalfa and Barley,  
W78-07397 3F

## WYZSZA SZKOLA PEDAGOGICZNA, GDANSK (POLAND). INST. OF BIOLOGY.

Investigation of Oil Pollution on the Polish Baltic Coast in 1974/1975 (In Polish),  
W78-07265 5B

## YOUNGSTOWN STATE UNIV., OH. DEPT. OF CHEMICAL ENGINEERING.

Dye Infusion Technique Assesses Stream Pollution in Ohio,  
W78-07373 5B

## WEHRWISS. DIENSTSTELLE BUNSTSTELLE BUNDESWEHR ABC-SCHUTZ, MUENSTER (WEST GERMANY).

Detoxification of Staphylococcal-Enterotoxin B in Water (In German),  
W78-07232 5F

## WESTERN REGIONAL RESEARCH LAB., BERKELEY, CA.

Binding of Heavy Metal Ions by Formaldehyde-Polymerized Peanut Skins,  
W78-07594 5D

## WESTLANDS WATER DISTRICT, FRESNO, CA.

Local Solutions to Drainage Problems,  
W78-07638 4A

## WICHITA SEWER MAINTENANCE OFFICE, KS.

Grouting Provides Economical and Effective Maintenance in Kansas,  
W78-07421 8G

## WISCONSIN COOPERATIVE FISHERY RESEARCH UNIT, STEVENS POINT.

Effects of Stream Channelization on Terrestrial Wildlife and Their Habitats in the Buena Vista Marsh, Wisconsin,  
W78-07228 6G

## WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON. BUREAU OF RESEARCH.

Northern Pike Production in Managed Spawning and Rearing Marshes,  
W78-07293 5C

## WISCONSIN UNIV.-MADISON. DEPT. OF GEOLOGY AND GEOPHYSICS.

Impact of a Power Plant on the Ground-Water System of a Wetland,  
W78-07377 6G

## WISCONSIN UNIV.-MADISON. DEPT. OF SOIL SCIENCE.

Steady-State Solute Convection in Two Dimensions with Nonuniform Infiltration,  
W78-07381 2G

## WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA. MARINE POLICY AND OCEAN MANAGEMENT PROGRAM.

Sub-Seabed Disposal of Radioactive Waste: Prevention or Management,  
W78-07536 5E

## WORCESTER POLYTECHNIC INST., MA. DEPT. OF CIVIL ENGINEERING.

Capacity Planning for Regional Wastewater Treatment Systems,  
W78-07521 5D

## WYOMING UNIV., LARAMIE. COLL. OF LAW.

Case Note: Water and Water Courses -- Limiting the Reservation Doctrine. Mimbres Valley Irrigation Co. v. Salopek, 564 P.2d 615(N.M.1977),cert.granted,46U.S.L.W. 3426(No.77-510),  
W78-07211 6E

W78-0726  
W78-0727  
W78-0728  
W78-0729  
W78-0730  
W78-0731  
W78-0732  
W78-0733  
W78-0734  
W78-0735  
W78-0736  
W78-0737  
W78-0738  
W78-0739  
W78-0740  
W78-0741  
W78-0742  
W78-0743  
W78-0744  
W78-0745  
W78-0746  
W78-0747  
W78-0748  
W78-0749  
W78-0750  
W78-0751  
W78-0752  
W78-0753  
W78-0754  
W78-0755  
W78-0756  
W78-0757  
W78-0758  
W78-0759  
W78-0760  
W78-0761  
W78-0762  
W78-0763  
W78-0764  
W78-0765  
W78-0766  
W78-0767  
W78-0768  
W78-0769  
W78-0770  
W78-0771  
W78-0772  
W78-0773  
W78-0774  
W78-0775  
W78-0776  
W78-0777  
W78-0778  
W78-0779  
W78-0780  
W78-0781  
W78-0782  
W78-0783  
W78-0784  
W78-0785  
W78-0786  
W78-0787  
W78-0788  
W78-0789  
W78-0790  
W78-0791  
W78-0792  
W78-0793  
W78-0794  
W78-0795  
W78-0796  
W78-0797  
W78-0798  
W78-0799  
W78-0800



# ACCESSION NUMBER INDEX

|           |    |           |    |           |    |           |    |
|-----------|----|-----------|----|-----------|----|-----------|----|
| W78-07201 | 8C | W78-07279 | 5C | W78-07357 | 4B | W78-07435 | 5D |
| W78-07202 | 2K | W78-07280 | 6B | W78-07358 | 4B | W78-07436 | 5D |
| W78-07203 | 5C | W78-07281 | 2L | W78-07359 | 4A | W78-07437 | 5D |
| W78-07204 | 5C | W78-07282 | 3F | W78-07360 | 4A | W78-07438 | 5D |
| W78-07205 | 5C | W78-07283 | 2I | W78-07361 | 2B | W78-07439 | 5D |
| W78-07206 | 5B | W78-07284 | 2I | W78-07362 | 8F | W78-07440 | 5D |
| W78-07207 | 5D | W78-07285 | 5C | W78-07363 | 2J | W78-07441 | 5D |
| W78-07208 | 5A | W78-07286 | 5C | W78-07364 | 5B | W78-07442 | 5D |
| W78-07209 | 5C | W78-07287 | 5C | W78-07365 | 4B | W78-07443 | 5D |
| W78-07210 | 2H | W78-07288 | 5B | W78-07366 | 2L | W78-07444 | 5D |
| W78-07211 | 6E | W78-07289 | 5B | W78-07367 | 2K | W78-07445 | 5D |
| W78-07212 | 8B | W78-07290 | 5C | W78-07368 | 4B | W78-07446 | 5D |
| W78-07213 | 5C | W78-07291 | 5G | W78-07369 | 2C | W78-07447 | 5D |
| W78-07214 | 5C | W78-07292 | 5C | W78-07370 | 5G | W78-07448 | 5D |
| W78-07215 | 5D | W78-07293 | 5C | W78-07371 | 4D | W78-07449 | 5E |
| W78-07216 | 5B | W78-07294 | 5C | W78-07372 | 2C | W78-07450 | 5D |
| W78-07217 | 5D | W78-07295 | 2L | W78-07373 | 5B | W78-07451 | 5D |
| W78-07218 | 5B | W78-07296 | 5C | W78-07374 | 2B | W78-07452 | 5D |
| W78-07219 | 5C | W78-07297 | 5C | W78-07375 | 4A | W78-07453 | 5A |
| W78-07220 | 6B | W78-07298 | 5C | W78-07376 | 4C | W78-07454 | 5A |
| W78-07221 | 6F | W78-07299 | 5D | W78-07377 | 6G | W78-07455 | 5D |
| W78-07222 | 5G | W78-07300 | 5C | W78-07378 | 2F | W78-07456 | 5A |
| W78-07223 | 5C | W78-07301 | 5D | W78-07379 | 2J | W78-07457 | 5D |
| W78-07224 | 2L | W78-07302 | 5C | W78-07380 | 2A | W78-07458 | 5A |
| W78-07225 | 2H | W78-07303 | 5C | W78-07381 | 2G | W78-07459 | 7B |
| W78-07226 | 2L | W78-07304 | 5C | W78-07382 | 2A | W78-07460 | 5A |
| W78-07227 | 4A | W78-07305 | 5C | W78-07383 | 2G | W78-07461 | 5D |
| W78-07228 | 6G | W78-07306 | 5C | W78-07384 | 2A | W78-07462 | 5A |
| W78-07229 | 2L | W78-07307 | 5B | W78-07385 | 2A | W78-07463 | 5F |
| W78-07230 | 2L | W78-07308 | 5C | W78-07386 | 2G | W78-07464 | 5D |
| W78-07231 | 5D | W78-07309 | 5C | W78-07387 | 2F | W78-07465 | 5D |
| W78-07232 | 5F | W78-07310 | 2L | W78-07388 | 2E | W78-07466 | 5D |
| W78-07233 | 5G | W78-07311 | 2L | W78-07389 | 2F | W78-07467 | 5D |
| W78-07234 | 5A | W78-07312 | 7C | W78-07390 | 4A | W78-07468 | 5D |
| W78-07235 | 3F | W78-07313 | 7C | W78-07391 | 2E | W78-07469 | 5B |
| W78-07236 | 5D | W78-07314 | 7C | W78-07392 | 2D | W78-07470 | 5A |
| W78-07237 | 3F | W78-07315 | 4A | W78-07393 | 5D | W78-07471 | 5B |
| W78-07238 | 5D | W78-07316 | 4A | W78-07394 | 2F | W78-07472 | 2L |
| W78-07239 | 5G | W78-07317 | 4A | W78-07395 | 7C | W78-07473 | 5B |
| W78-07240 | 5D | W78-07318 | 5C | W78-07396 | 5G | W78-07474 | 5D |
| W78-07241 | 5A | W78-07319 | 5B | W78-07397 | 3F | W78-07475 | 5G |
| W78-07242 | 3F | W78-07320 | 5B | W78-07398 | 5C | W78-07476 | 5D |
| W78-07243 | 3F | W78-07321 | 5F | W78-07399 | 5G | W78-07477 | 5D |
| W78-07244 | 3F | W78-07322 | 5C | W78-07400 | 5G | W78-07478 | 5D |
| W78-07245 | 5D | W78-07323 | 5A | W78-07401 | 4A | W78-07479 | 8G |
| W78-07246 | 5F | W78-07324 | 5G | W78-07402 | 5G | W78-07480 | 6E |
| W78-07247 | 5D | W78-07325 | 5B | W78-07403 | 6G | W78-07481 | 5G |
| W78-07248 | 5D | W78-07326 | 4A | W78-07404 | 5A | W78-07482 | 5C |
| W78-07249 | 5D | W78-07327 | 2L | W78-07405 | 2L | W78-07483 | 5B |
| W78-07250 | 5D | W78-07328 | 5A | W78-07406 | 2H | W78-07484 | 5B |
| W78-07251 | 5F | W78-07329 | 5A | W78-07407 | 2J | W78-07485 | 2L |
| W78-07252 | 5D | W78-07330 | 4D | W78-07408 | 2L | W78-07486 | 2J |
| W78-07253 | 5G | W78-07331 | 5A | W78-07409 | 5D | W78-07487 | 8B |
| W78-07254 | 5D | W78-07332 | 5D | W78-07410 | 6E | W78-07488 | 8B |
| W78-07255 | 5D | W78-07333 | 5D | W78-07411 | 6E | W78-07489 | 8B |
| W78-07256 | 5D | W78-07334 | 5A | W78-07412 | 6E | W78-07490 | 5B |
| W78-07257 | 5G | W78-07335 | 5G | W78-07413 | 6E | W78-07491 | 8B |
| W78-07258 | 4A | W78-07336 | 5G | W78-07414 | 8G | W78-07492 | 8B |
| W78-07259 | 5D | W78-07337 | 6B | W78-07415 | 8G | W78-07493 | 2E |
| W78-07260 | 5B | W78-07338 | 5D | W78-07416 | 8G | W78-07494 | 2E |
| W78-07261 | 5G | W78-07339 | 2I | W78-07417 | 8C | W78-07495 | 5B |
| W78-07262 | 5C | W78-07340 | 8B | W78-07418 | 5D | W78-07496 | 2G |
| W78-07263 | 5C | W78-07341 | 2L | W78-07419 | 5E | W78-07497 | 2G |
| W78-07264 | 5C | W78-07342 | 4A | W78-07420 | 8G | W78-07498 | 2G |
| W78-07265 | 5B | W78-07343 | 5B | W78-07421 | 8G | W78-07499 | 2G |
| W78-07266 | 5G | W78-07344 | 4A | W78-07422 | 5D | W78-07500 | 2F |
| W78-07267 | 5C | W78-07345 | 4A | W78-07423 | 8C | W78-07501 | 2H |
| W78-07268 | 5B | W78-07346 | 2C | W78-07424 | 5D | W78-07502 | 2E |
| W78-07269 | 5A | W78-07347 | 7C | W78-07425 | 5D | W78-07503 | 2G |
| W78-07270 | 5D | W78-07348 | 5B | W78-07426 | 5D | W78-07504 | 2J |
| W78-07271 | 5A | W78-07349 | 7C | W78-07427 | 5D | W78-07505 | 4D |
| W78-07272 | 5C | W78-07350 | 4A | W78-07428 | 5D | W78-07506 | 5B |
| W78-07273 | 5A | W78-07351 | 2F | W78-07429 | 5D | W78-07507 | 2B |
| W78-07274 | 5C | W78-07352 | 8B | W78-07430 | 5D | W78-07508 | 6D |
| W78-07275 | 5C | W78-07353 | 5C | W78-07431 | 5D | W78-07509 | 2L |
| W78-07276 | 7B | W78-07354 | 5B | W78-07432 | 5D | W78-07510 | 4A |
| W78-07277 | 5A | W78-07355 | 4A | W78-07433 | 5D | W78-07511 | 8D |
| W78-07278 | 5A | W78-07356 | 5B | W78-07434 | 5D | W78-07512 | 8D |

# ACCESSION NUMBER INDEX

W78-07513

|           |    |           |    |           |    |
|-----------|----|-----------|----|-----------|----|
| W78-07513 | 8D | W78-07592 | 5D | W78-07671 | 8B |
| W78-07514 | 8D | W78-07593 | 5D | W78-07672 | 8B |
| W78-07515 | 5D | W78-07594 | 5D | W78-07673 | 5E |
| W78-07516 | 5D | W78-07595 | 5D | W78-07674 | 5E |
| W78-07517 | 5A | W78-07596 | 5G | W78-07675 | 5E |
| W78-07518 | 5D | W78-07597 | 5A | W78-07676 | 7B |
| W78-07519 | 5D | W78-07598 | 5D | W78-07677 | 5C |
| W78-07520 | 5B | W78-07599 | 5D | W78-07678 | 5A |
| W78-07521 | 5D | W78-07600 | 5D | W78-07679 | 8B |
| W78-07522 | 5A | W78-07601 | 5D | W78-07680 | 8C |
| W78-07523 | 5D | W78-07602 | 5D | W78-07681 | 5G |
| W78-07524 | 5F | W78-07603 | 5D | W78-07682 | 5E |
| W78-07525 | 5A | W78-07604 | 5F | W78-07683 | 5B |
| W78-07526 | 5D | W78-07605 | 5C | W78-07684 | 5C |
| W78-07527 | 5D | W78-07606 | 5G | W78-07685 | 6A |
| W78-07528 | 5G | W78-07607 | 5G | W78-07686 | 2J |
| W78-07529 | 5E | W78-07608 | 5B | W78-07687 | 6B |
| W78-07530 | 5D | W78-07609 | 5B | W78-07688 | 2G |
| W78-07531 | 5D | W78-07610 | 5B | W78-07689 | 2A |
| W78-07532 | 5D | W78-07611 | 5G | W78-07690 | 2A |
| W78-07533 | 5D | W78-07612 | 5B | W78-07691 | 2A |
| W78-07534 | 5D | W78-07613 | 5G | W78-07692 | 2A |
| W78-07535 | 8G | W78-07614 | 5B | W78-07693 | 2A |
| W78-07536 | 5E | W78-07615 | 5B | W78-07694 | 2A |
| W78-07537 | 2L | W78-07616 | 5G | W78-07695 | 2A |
| W78-07538 | 2L | W78-07617 | 5B | W78-07696 | 2A |
| W78-07539 | 5B | W78-07618 | 5G | W78-07697 | 2A |
| W78-07540 | 5E | W78-07619 | 5G | W78-07698 | 2A |
| W78-07541 | 2L | W78-07620 | 5G | W78-07699 | 2A |
| W78-07542 | 5B | W78-07621 | 5G | W78-07700 | 2A |
| W78-07543 | 2L | W78-07622 | 5G |           |    |
| W78-07544 | 5C | W78-07623 | 5B |           |    |
| W78-07545 | 5B | W78-07624 | 5B |           |    |
| W78-07546 | 5C | W78-07625 | 5G |           |    |
| W78-07547 | 5B | W78-07626 | 5G |           |    |
| W78-07548 | 2L | W78-07627 | 5G |           |    |
| W78-07549 | 5D | W78-07628 | 5G |           |    |
| W78-07550 | 5B | W78-07629 | 5G |           |    |
| W78-07551 | 2G | W78-07630 | 2G |           |    |
| W78-07552 | 5D | W78-07631 | 3F |           |    |
| W78-07553 | 5A | W78-07632 | 5B |           |    |
| W78-07554 | 2H | W78-07633 | 5G |           |    |
| W78-07555 | 2L | W78-07634 | 3C |           |    |
| W78-07556 | 5B | W78-07635 | 5G |           |    |
| W78-07557 | 6G | W78-07636 | 4A |           |    |
| W78-07558 | 6G | W78-07637 | 5G |           |    |
| W78-07559 | 6G | W78-07638 | 4A |           |    |
| W78-07560 | 6G | W78-07639 | 4A |           |    |
| W78-07561 | 6G | W78-07640 | 5G |           |    |
| W78-07562 | 6G | W78-07641 | 5G |           |    |
| W78-07563 | 6G | W78-07642 | 5G |           |    |
| W78-07564 | 6G | W78-07643 | 6E |           |    |
| W78-07565 | 6G | W78-07644 | 3C |           |    |
| W78-07566 | 6G | W78-07645 | 3C |           |    |
| W78-07567 | 6G | W78-07646 | 5G |           |    |
| W78-07568 | 6G | W78-07647 | 5G |           |    |
| W78-07569 | 6G | W78-07648 | 5B |           |    |
| W78-07570 | 5D | W78-07649 | 5G |           |    |
| W78-07571 | 5B | W78-07650 | 5G |           |    |
| W78-07572 | 8B | W78-07651 | 5G |           |    |
| W78-07573 | 6E | W78-07652 | 6E |           |    |
| W78-07574 | 6E | W78-07653 | 5G |           |    |
| W78-07575 | 2K | W78-07654 | 5G |           |    |
| W78-07576 | 5G | W78-07655 | 5C |           |    |
| W78-07577 | 4B | W78-07656 | 5D |           |    |
| W78-07578 | 6E | W78-07657 | 5D |           |    |
| W78-07579 | 8G | W78-07658 | 5D |           |    |
| W78-07580 | 5D | W78-07659 | 5D |           |    |
| W78-07581 | 4B | W78-07660 | 5D |           |    |
| W78-07582 | 8A | W78-07661 | 5C |           |    |
| W78-07583 | 4B | W78-07662 | 5C |           |    |
| W78-07584 | 5A | W78-07663 | 5C |           |    |
| W78-07585 | 8C | W78-07664 | 5C |           |    |
| W78-07586 | 5D | W78-07665 | 5A |           |    |
| W78-07587 | 5D | W78-07666 | 5E |           |    |
| W78-07588 | 5D | W78-07667 | 5A |           |    |
| W78-07589 | 5A | W78-07668 | 5C |           |    |
| W78-07590 | 5D | W78-07669 | 5B |           |    |
| W78-07591 | 5D | W78-07670 | 5B |           |    |

# ABSTRACT SOURCES

| SOURCE   | ACCESSION NUMBER  | TOTAL |
|--|---|-------|
| A. CENTERS OF COMPETENCE   |   |       |
| Colorado State University,<br>Irrigation Return Flow<br>Quality                              | W78-07606--07654  | 49    |
| Cornell University, Policy<br>Models for Water Resources<br>Systems                          | W78-07220--07222  | 3     |
| DOE Oak Ridge National<br>Laboratory, Nuclear<br>Radiation and Safety                        | W78-07219   | 1     |
| Franklin Institute (FIRL),<br>Municipal and Industrial<br>Wastewater Treatment<br>Technology | W78-07212<br>07214--07216<br>07255--07256<br>07259, 07333<br>07409<br>07414--07471<br>07473--07479<br>07481<br>07515--07535<br>07549, 07580<br>07586--07603<br>07656--07660<br>07666, 07675 | 123   |
| Illinois State Water Survey,<br>Hydrology  | W78-07258<br>07361--07382<br>07384--07392<br>07405--07406<br>07483--07514<br>07689<br>07691--07700  | 77    |
| National Water Well<br>Association, Water Well<br>Construction Technology                    | W78-07570--07579<br>07581--07585<br>07604   | 16    |
| University of Florida,<br>Eastern U. S. Water Law  | W78-07410--07413  | 4     |

# ABSTRACT SOURCES

| SOURCE  | ACCESSION NUMBER   | TOTAL | SOURCE |
|---|--|-------|--------|
| A. CENTERS OF COMPETENCE<br>(CONTINUED)   |  |       | C. O   |
| University of Wisconsin,<br>Eutrophication  | W78-07217--07218<br>07262--07264<br>07266, 07271<br>07273--07276<br>07280--07297<br>07299--07306<br>07308--07309 | 39    | N      |
| University of Wisconsin,<br>Water Resources Economics                                     | W78-07336--07337   | 2     | O      |
| B. STATE WATER RESOURCES<br>RESEARCH INSTITUTES   | W78-07201--07211<br>07318--07323<br>07393--07396<br>07398, 07480<br>07482<br>07683--07687                        | 24    | U      |
| C. OTHER  |  |       | U      |
| Army Engineer Waterways<br>Experiment Station   | W78-07669--07674<br>07676--07682   | 13    |        |
| BioSciences Information<br>Service  | W78-07213, 07223<br>07232<br>07260--07261<br>07265<br>07267--07270<br>07272, 07298<br>07307                      | 13    |        |
| Environmental Information<br>Services, Inc. (Effects<br>of Pollutants on Aquatic<br>Life) | W78-07605, 07655<br>07661--07665<br>07667--07668   |       |        |
| Fish and Wildlife Service   | W78-07563--07569   |       |        |



# ABSTRACT SOURCES

| TOTAL                       | SOURCE   | ACCESSION NUMBER   | TOTAL |
|-----------------------------|--|--|-------|
| <b>C. OTHER (CONTINUED)</b> |  |  |       |
| 39                          | National Oceanic and<br>Atmospheric Administration | W78-07383<br>07407--07408<br>07472<br>07536--07548<br>07550--07562 | 30    |
|                             | Ocean Engineering Infor.<br>Service (Patents)      | W78-07231<br>07233--07254<br>07257                                 | 24    |
| 2                           | Office of Water Research<br>and Technology         | W78-07397, 07688   | 2     |
| 29                          | U. S. Geological Survey                            | W78-07312--07317<br>07342--07360                                   | 25    |
|                             | University of Massachusetts<br>(Wetlands)          | W78-07224--07230<br>07279<br>07310--07311<br>07338--07341          | 14    |

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